National Park Service
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Natural Resource Stewardship and Science

National Park Service Vegetation Inventory Program

Buffalo National River, Arkansas

Natural Resource Report NPS/HTLN/NRR—2012/526



ON THE COVER
A view of the Buffalo National River from the Overlook Trail north of the Buffalo Point Ranger Station, Arkansas.
Photograph by Kevin Hop.

National Park Service Vegetation Inventory Program

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Executive Summary

The National Park Service (NPS) Vegetation Inventory Program (VIP) is an effort to classify, describe, and map existing vegetation of national park units for the NPS Natural Resource Inventory and Monitoring (I&M) Program. The NPS VIP is managed by the NPS Biological Resources Management Division and provides baseline vegetation information to the NPS Natural Resource I&M Program. The U.S. Geological Survey (USGS) Vegetation Characterization Program lends a cooperative role in the NPS VIP. The USGS Upper Midwest Environmental Sciences Center, NatureServe, and NPS Buffalo National River (BUFF) have completed vegetation classification and mapping of the BUFF.

Photointerpreters, ecologists, and botanists collaborated to identify and describe vegetation types within the National Vegetation Classification Standard (NVCS) and to determine how best to map them by using aerial photographs. The team collected 250 vegetation sampling plots within the BUFF. Furthermore, data from 891 accuracy assessment (AA) sites were collected (of which 889 were used to test accuracy of the vegetation map layer). These data sets led to the identification of 56 vegetation types at the associations in the NVCS at BUFF. Two additional vegetation types are recognized at the group level in the NVCS.

A total of 29 map classes were developed to map the vegetation and general land cover of BUFF, including the following: 26 map classes representing natural/semi-natural vegetation types in the NVCS, one map class representing cultural vegetation (e.g., developed lands) in the NVCS, and two map classes representing non-vegetation features (e.g., open-water bodies). Features were interpreted from viewing color-infrared aerial imagery dated October 2006 (during fall leaf change) via digital-onscreen three-dimensional stereoscopic workflow systems in geographic information systems (GIS). The interpreted data were digitally and spatially referenced, making the spatial database layers usable in GIS. Environmental models were used to further separate vegetation types where visual interpretation was limited or not possible.

Polygon units were mapped to either a 0.5 ha or 0.25 ha minimum mapping unit, depending on vegetation type. Ancillary sets of aerial imagery from November 2005 (near leaf off) and from the 1930s (historic land use) were used for additional reference during mapping.

A geodatabase containing various feature-class layers and tables show the locations of vegetation types and general land cover (vegetation map), vegetation plot samples, AA sites, project boundary extent, and aerial photographic centers. The feature class layer for the BUFF vegetation map provides 11,279 polygons of detailed attribute data covering 37,828.4 ha, with an average polygon size of 3.4 ha.

Summary reports generated from the vegetation map layer indicate that 11,129 polygons (98.7%) represent natural/semi-natural types in the NVCS and encompass 36,421.4 ha (96.3%) of the total map extent. The Mixed Oak - (Hardwood) Dry Forest (FDO) is the dominant map class, according to both frequency of occurrence and area coverage. The FDO map class contributes 2,692 polygons (23.9% of all polygons) and covers 18,978.9 ha (50.2% of all area), with an average polygon size of 7.1 ha. A thematic AA study was conducted of map classes representing natural/semi-natural types in the NVCS. Results present an overall accuracy of 78.9% (kappa

index of 77.3%) based on data from 889 of the 891 AA sites. Most individual map-class themes exceed the NPS VIP standard of 80% with a 90% confidence interval.

The BUFF vegetation mapping project delivers many geospatial and vegetation data products in hardcopy and digital formats. These products consist of an in-depth project report discussing methods and results, which include descriptions and a dichotomous key to vegetation types, map classification and map-class descriptions, and a contingency table showing AA results. The suite of products also includes ground photos of vegetation types; a database of vegetation plots and AA sites; field data sheets; aerial photographic prints and images; hardcopy and digital maps; and a geodatabase of vegetation types (map layer), fieldwork locations (vegetation plots and AA sites), aerial photographic indexes, a project boundary, and metadata. All geospatial products are projected in Universal Transverse Mercator, Zone 15, by using the North American Datum of 1983. More NPS VIP information and products of completed park mapping projects are on the Internet at <http://science.nature.nps.gov/im/inventory/veg> and <http://biology.usgs.gov/npsveg>.

Acknowledgments

The success of this complex project was dependent on the collaborative efforts of several individuals from various organizations. The dedicated folks who worked on this project collectively have a wide array of skill and expertise, essential in moving the National Park Service (NPS) Buffalo National River (BUFF) vegetation mapping project to its completion. We wish to acknowledge those individuals who have been essential in making this project a success.

We respectfully thank the NPS Vegetation Inventory Program (VIP) and the U.S. Geological Survey (USGS) Vegetation Characterization Program (VCP) staff for entrusting this project to us, including Karl Brown (NPS VIP Coordinator) for funding the BUFF vegetation mapping project, Mike Mulligan (USGS VCP Coordinator) for providing additional funding support for the vegetation mapping effort, and Tammy Cook (NPS VIP) and Peter Budde (NPS Natural Resource Program GIS Coordinator) for giving us guidance when we needed it.

Thanks are also in order to the NPS BUFF staff—particularly Chuck Bitting—for hosting this project, with its series of meetings, training sessions, and field efforts. Chuck was also particularly helpful to the field crews as a liaison with other park staff by arranging housing, setting up transportation as needed, and connecting field crews with private landowners whose permission for access facilitated sampling of difficult-to-reach plots. Since landscape of the BUFF is extremely rugged, Chuck and his staff were also key collaborators in helping our teams understand how to reach points safely and efficiently.

We also acknowledge and thank our field teams who spent many hours collecting the data that formed the basis of so much of this project. We thank Theo Witsell (Arkansas Natural Heritage Commission) for his assistance in spearheading the fieldwork, classification, and field key writing process. Theo also shared duties in providing overall guidance and supervision of numerous field crews. We recognize Dr. Johnnie Gentry, Brent Baker, Steve Smith, Burnetta Hinterthuer, R. McElderry, L. Urban, M. Williams, Jeremy Whisenhunt, Theo Witsell, and Chuck Bitting for their work in collecting initial vegetation plots. We also recognize our field team for data collection at accuracy assessment (AA) sites, including Jeremy Whisenhunt, Sam Sheline, Jennifer Ogle, Phyllis Jackson, Jeff Jackson, Mike Miller, Burnetta Hinterthuer, Steve Smith, and Lindsey Smart. We are especially grateful to Sam Sheline, Jeff Jackson, and Phyllis Jackson, who all volunteered some of their time to ensure that all of the plot data could be collected on time and on budget.

We also would like to express our appreciation to the USGS Mid-Continent Geographic Science Center for their involvement mid-way through this project. Special thanks go to Keith Landgraf for his diligent assistance with exploring, testing, and processing various environmental data sets for our modeling efforts with the mapping. Thanks are also in order to Keith for providing a quality control/quality assurance of the mapping portions where we used these environmental models.

We finally thank our colleagues from within our own offices—the USGS Upper Midwest Environmental Sciences Center and NatureServe. Of the USGS, we acknowledge Eric Seeger and Erin Hoy for their diligent efforts in mapping the BUFF by employing newly acquired mapping technology (three-dimensional [3D] on-screen digital mapping); Janis Ruhser for

producing stereo models for 3D mapping; JC Nelson and Larry Robinson for keeping 3D mapping stations functional, as well as JC's assistance with random-site selection for AA and the metadata generation of feature class layers within the geodatabase; Tim Fox for compiling the cost-surface model for the AA site selection; and Joe Jakusz for his diligent work in building the geodatabase with the suite of feature classes and relationship tables. Of NatureServe, we acknowledge Heather Summer for her coordination role in the beginning of the project, Mary Russo for getting classification data into and out of the central database of NatureServe with ease and speed, and Lindsey Smart for her work on preparing maps for field teams.

This project required the cooperation and assistance of many individuals. Their diligence in working on this multifarious project is highly regarded and appreciated because their labors went toward so many aspects of this project—from developing the vegetation classification to creating the spatial geodatabase.

Introduction

Buffalo National River Vegetation Mapping Project

The Buffalo National River (BUFF) vegetation mapping project is an initiative of the National Park Service (NPS) Vegetation Inventory Program (VIP), with cooperative support from the U.S. Geological Survey (USGS) Vegetation Characterization Program (VCP) to classify and map vegetation types of the BUFF. The goals of the project are to adequately describe and the map vegetation types of the BUFF and to provide the NPS Natural Resource Inventory and Monitoring (I&M) Program, resource managers, and biological researchers with useful baseline vegetation information.

The BUFF vegetation mapping project was officially inaugurated in spring of 2004, with a scoping meeting wherein partners discussed project objectives, goals, and methods. Major collaborators at this meeting included staff from the NPS VIP, the NPS BUFF, NatureServe, Arkansas Natural Heritage Commission, and the USGS Upper Midwest Environmental Sciences Center. Common to all NPS VIP projects, the three major components of the BUFF vegetation mapping project are as follows: (1) vegetation classification, (2) vegetation mapping, and (3) map accuracy assessment. In this report, each of these fundamental components is discussed in detail.

The National Park Service Vegetation Inventory Program

The NPS VIP is an effort to classify, describe, and map existing vegetation of national park units. Managed by the NPS Biological Resources Management Division, the NPS VIP provides baseline vegetation information for the NPS Natural Resource I&M Program. The USGS VCP lends a cooperative role in the NPS VIP. Vegetation layers and associated information support a wide variety of resource assessment, park management, and planning needs. They also provide structure for framing and answering critical scientific questions about vegetation communities and their relation to environmental processes across the landscape.

Program scientists developed procedures for classification, mapping, and accuracy assessment (The Nature Conservancy [TNC] and Environmental Systems Research Institute 1994a, 1994b, TNC et al. 1994, NatureServe 2004). Ecology and mapping teams worked together to share knowledge and data and to resolve issues regarding classification and mapping procedures. The NPS VIP products meet Federal Geographic Data Committee (FGDC) standards for vegetation classification and metadata and meet national standards for spatial accuracy and data transfer. Mapping standards include a minimum mapping unit (MMU) of 0.5 ha and a classification accuracy meeting or exceeding 80% (with a 90% confidence level) for map classes representing vegetation types in the National Vegetation Classification Standard (NVCS). All geospatial products are projected in Universal Transverse Mercator (UTM) and use the North American Datum of 1983 (NAD83).

The NPS VIP provides an array of data products. Mapping products include aerial photographs, spatial databases of vegetation (including metadata), a map classification description or key, hard-copy maps of vegetation, and an accuracy assessment of vegetation map. Vegetation products include vegetation classification, a dichotomous field key to the vegetation classes, formal descriptions and ground photos of the vegetation types, and field data in database format.

More NPS VIP information and products of completed park mapping projects are on the Internet at <http://science.nature.nps.gov/im/inventory/veg> and <http://biology.usgs.gov/npsveg>.

Natural Resource Inventory and Monitoring Program

The NPS Natural Resource I&M Program is a long-term effort to acquire information needed to help maintain ecosystem integrity for all NPS units with significant natural resources. One of the long-term goals of the I&M Program is to produce baseline inventories of basic biological and geophysical natural resources. The NPS VIP provides detailed vegetation maps based on aerial photographs and meets specified thematic accuracy standards (80%) set by the I&M Program. More information on the I&M Program is available on the Internet at <http://science.nature.nps.gov/im/index.cfm>.

Vegetation Inventory Program Standards

The NPS VIP uses nationally defined standards, some of which are maintained by the FGDC. These include the following:

- National Vegetation Classification Standard (FGDC 2008),
- Content Standard for Digital Geospatial Metadata (FGDC 1998a),
- Spatial Data Transfer Standard (FGDC 1998b),
- United States National Map Accuracy Standards (U.S. Geological Survey 1999), and
- Integrated Taxonomic Information System (U.S. Department of Agriculture).

Descriptions and links to websites for these standards can be accessed at <http://biology.usgs.gov/npsveg/standards.html>.

The National Vegetation Classification Standard

In 1997, the FGDC adopted the Vegetation Classification Standard: FGDC-STD-005-1997 (FGDC 1997). Since then, the FGDC Vegetation Subcommittee has derived a major revision, which is the National Vegetation Classification Standard, Version 2: FGDC-STD-005-2008 (Version 2) (FGDC 2008). This revision was an effort to foster a cohesive view between Federal agencies in their approach to classifying vegetation, thus reducing duplicative efforts among multiple agencies. Version 2 replaced the original and addressed several issues known with the first version and included a substantial reorganization of the classification hierarchical structure. The purpose of the classification standard is to promote consistent classification of vegetation resources across regions. The use of a national standard aids effective resource stewardship by augmenting compatibility and widespread use of the information throughout the NPS and other Federal and State agencies.

The NVCS classifies existing vegetation within a hierarchical structure. In brief, the classification is separated into two overriding categories, including natural vegetation (including semi-natural) and cultural vegetation. From there, each category is further divided into three main sections, including the following: (1) Upper (where physiognomy plays a predominant role), (2) Middle (where both floristics and physiognomy play a significant role), and (3) Lower (where floristics plays a predominant role). Within each section, additional levels are subset. Separate hierarchies are developed for cultural and natural vegetation types. Tables 1 and 2 show the hierarchical structures for both natural and cultural vegetation types. Definitions of these various levels are detailed within Section 2 of the NVCS (FGDC 2008); however, with the

emphasis given by the NPS VIP to natural/semi-natural vegetation types of the floristic levels (alliance and association) and the group level of the NVCS, the following brief definitions are provided:

- An association-level type is the finest level of the NVCS and is "defined on the basis of a characteristic range of species composition, diagnostic species occurrence, habitat conditions and physiognomy" (Jennings et al. 2006, as quoted in FGDC 2008:14). "Associations reflect topo-edaphic climate, substrates, hydrology, and disturbance regimes" (FGDC 2008:14).
- An alliance-level type is hierarchically one level above the association and is "defined by a characteristic range of species composition, habitat conditions, physiognomy, and diagnostic species, typically at least one of which is found in the uppermost or dominant stratum of the vegetation" (Jennings et al. 2006, as quoted in FGDC 2008:14). "Alliances reflect regional to subregional climate, substrates, hydrology, moisture/nutrient factors, and disturbance regimes" (FGDC 2008:14).
- A group-level type is hierarchically one level above the alliance (two levels above association) yet is also the lowest level of the middle section of the NVCS hierarchy. The group level is defined in Table 2.4 of the NVCS as "combinations of relatively narrow sets of diagnostic plant species (including dominants and co-dominants), broadly similar composition, and diagnostic growth forms that reflect biogeographic differences in composition and sub-continental to regional differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes" (FGDC 2008:17).

Table 1. Hierarchy for natural/semi-natural vegetation (with examples) in the National Vegetation Classification Standard, Version 2 (FGDC 2008).

Level	Example
Upper: Physiognomy plays a predominant role.	
Formation Class	Forest to Open Woodland (1.)
Formation Subclass	Temperate & Boreal Forest (1.B.)
Formation	Cool Temperate Forest (1.B.2.)
Middle: Both floristics and physiognomy play a significant role.	
Division	Eastern North American Cool Temperate Forest (1.B.2.Na./D008.)
Macrogroup	Central Mesophytic Hardwood Forest (M153.)
Group	Appalachian & Interior Mesophytic Forest (G020.)
Lower: Floristics plays a predominant role.	
Alliance	*Quercus rubra* - (*Acer saccharum*) Forest (A.251)
Association	*Quercus alba - Quercus rubra - Acer saccharum - Carya cordiformis / Lindera benzoin* Forest (CEGL002058)

Table 2. Hierarchy for cultural vegetation (with examples) in the National Vegetation Classification Standard, Version 2 (FGDC 2008).

Level	Example
Upper: Physiognomy plays a predominant role.	
Cultural Class	Agricultural Vegetation
Cultural Subclass	Herbaceous Agricultural Vegetation
Cultural Formation	Pasture / Hay
Cultural Subformation	Permanent Pasture & Hayland
Middle: Both floristics and physiognomy play a significant role.	
Cultural Group *[optional]*	Temperate and Tropical Permanent Pasture & Hayland
Cultural Subgroup	Grass
Lower: Floristics plays a predominant role.	
Cultural Type	Co-dominance of tall fescue & perennial ryegrass
Cultural Subtype *[optional]*	

Content Standard for Digital Geospatial Metadata

Metadata are data that describe the content, quality, condition, and other characteristics of other data. As a standard product, the NPS VIP employs FGDC-compliant metadata files for each spatial data set it produces. In 1998, the FGDC approved the Content Standard for Digital Geospatial Metadata, FGDC-STD-001-1998 (FGDC 1998a). This metadata standard uses a common set of terminology and definitions to document digital geospatial data.

Buffalo National River

The BUFF (Figure 1) is located in northwest Arkansas and comprises an area of nearly 38,000 ha. The BUFF is managed in three districts, as follows:

- Upper River—Upper Buffalo Wilderness to Mt. Hersey,
- Middle River—Mt. Hersey to Maumee,
- Lower River—Maumee to Lower Buffalo Wilderness.

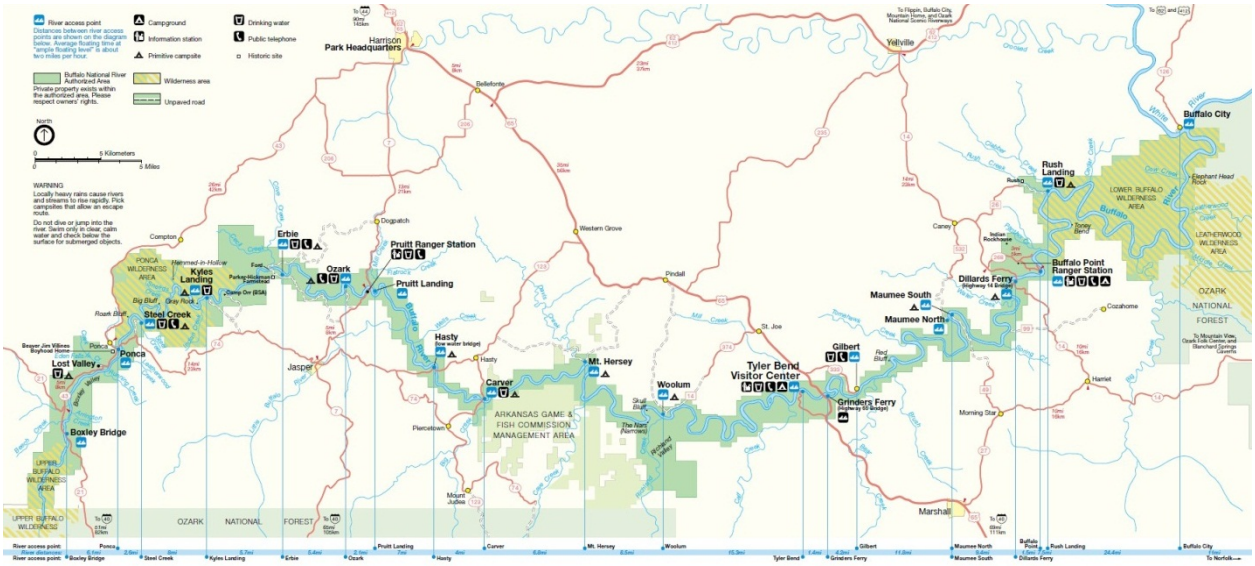


Figure 1. Buffalo National River, Arkansas (courtesy nps.gov).

The western-most end of the BUFF includes a portion of the Upper Buffalo Wilderness, and the eastern-most end includes a portion of the Lower Buffalo Wilderness. Also in the western end is the Ponca Wilderness just downstream from the Boxley Valley. In 1972, the U.S. Congress designated the BUFF as America's first national river unit to preserve the free-flowing Buffalo River for the benefit and enjoyment of present and future generations. The headquarters for the BUFF are located in Harrison, Arkansas.

The BUFF winds through the Arkansas Ozarks as a fully protected, non-impounded river and flows for more than 240 km from its headwaters in the Boston Mountains eastward to its confluence with the White River. About 217 km of the river flows wild through the BUFF lands as it meanders through a narrow corridor of sandstone, limestone, and dolomite bluffs. The terrain surrounding the river is rugged with steep and vertical bluffs rising nearly 135 m from the river's edge, some of the highest river bluffs in the Ozarks (Figure 2). The elevation peaks at nearly 730 m in the Boston Mountains and 122 m at the confluence of the Buffalo and White Rivers. The mostly forested lands on either side of the Buffalo River continue as rugged lands with steep slopes, hills, valleys, and narrow ridge tops (Figure 3).



Figure 2. Vertical bluffs along the Buffalo River within the Buffalo National River, Arkansas.



Figure 3. Forest lands on the rugged terrains of the Buffalo National River, Arkansas.

The hardwood forests range from dry to mesic and consist mostly of oaks and hickories, although American Beech forests have become commonplace in mesic locations of the Boxley Valley area (Figure 4). The more dry-xeric oak forests are standard with post oak and blackjack oak, whereas the dry-mesic oak-hardwood forests are standard with white oak, red oak, and hickories. These oak-hardwood forests are the dominant forests at the BUFF. Chinkapin oak tends to range from dry-mesic to xeric. Mesic oak-hardwood forests consist of red oak and sugar maple. Conifer forests and woodlands consist of shortleaf pine and/or eastern red-cedar; conifer-glade woodlands consist of red-cedar and Ashe's juniper (Figure 5). Many forests and woodlands are also a mix of the conifers and oak-hardwoods discussed above. Both oak-hardwood and conifer woodlands are speckled throughout the landscape on dry-xeric sites. Early successional forests are typically not oak dominant but rather consist of sweetgum, black walnut, honeylocust, black locust, and/or a variety of other hardwood trees common to disturbance sites. The riparian hardwood forests along the Buffalo River and its tributaries, whether large or small, consist mostly of silver maple, American sycamore, green ash, and/or American elm. Riparian shrub wetlands are common along the Buffalo River, intermingled with the margins of the riparian hardwood forests.



Figure 4. A beech-hardwood forest in the vicinity of the Boxley Valley, Buffalo National River, Arkansas.



Figure 5. A conifer-glade woodland consisting of Ashe's juniper and eastern red-cedar, Buffalo National River, Arkansas.

Small herbaceous glades rest alongside the bluffs of the Buffalo River and are closely intermingled with conifer or hardwood glade woodlands (Figure 6). Other herbaceous lands are ruderal in function, either old fields reverting to warm-season grass mixtures or fields kept as cool-season grasses for haying and pasturing (Figure 7), which is common practice within the broad basin of the Boxley Valley. Herbaceous wetlands are uncommon, with the most prominent one located in the Boxley Valley, which is spring fed from the surrounding uplands (Figure 8).



Figure 6. An herbaceous glade nestled within a hardwood woodland, Buffalo National River, Arkansas.



Figure 7. A cool-season herbaceous meadow for hay and pasture in the Boxley Valley, Buffalo National River, Arkansas.



Figure 8. A spring-fed herbaceous wetland in the Boxley Valley, Buffalo National River, Arkansas.

Project Overview

General Process

The three main components of the Buffalo National River (BUFF) vegetation mapping project are as follows: (1) vegetation classification, (2) vegetation mapping, and (3) map accuracy assessment (AA). Our objectives were to identify and map existing vegetation types of BUFF. Table 3 provides a timeline outlining the events discussed in the following paragraphs.

Table 3. Timeline by year and task of the Buffalo National River (Arkansas) vegetation mapping project.

Note: each year in the table is split into four blocks to better approximate when the bulk of a particular task effort was performed. These blocks represent January–March, April–June, July–September, and October–December.
[AA, Accuracy Assessment; Clsf, Classification; Mtg, Meeting; Recon, Reconnaissance; Veg, Vegetation]

Task	2004	2005	2006	2007	2008	2009	2010	2011	2012
Scope Mtg 1									
Initial Site Visits									
Aerial Photos 1									
Scope Mtg 2									
Aerial Photos 2									
Veg Plots									
Model Recon									
Model Pre-Clsf									
Veg Clsf									
Map Clsf Mtg									
Map Recon									
Map Verification									
Veg Mapping									
AA Field									
AA Analysis									
Wrap-up									
Close-out									

The initial scoping meeting to kick off the BUFF vegetation mapping project was held May 17–19, 2004, at the headquarters of the BUFF in Harrison, Arkansas. A second scoping meeting to kick off the vegetation sampling effort was held March 9–10, 2006, again at the headquarters of the BUFF. At these meetings, primary partners—including the National Park Service (NPS) Vegetation Inventory Program (VIP), NPS BUFF, U.S. Geological Survey (USGS) Upper

Midwest Environmental Science Center (UMESC), USGS Mid-Continent Geographic Science Center (MCGSC), NatureServe, and the Arkansas Natural Heritage Commission (ANHC)—met to discuss and plan the vegetation mapping project. The 2004 meeting had the following objectives:

- Inform BUFF staff of the classification and mapping project,
- Learn about management and science issues and concerns at the BUFF,
- Learn about existing data,
- Develop an action plan for vegetation classification and mapping,
- Discuss the project boundary extent, and
- Field tour of various vegetation types at the BUFF (Figure 9).



Figure 9. Field tour in order to view vegetation types at the Buffalo National River (Arkansas) with participants from the scoping meeting for the Buffalo National River vegetation mapping project.

At the 2006 meeting, the following items were discussed:

- Current status of the NPS VIP and the BUFF vegetation mapping project,
- Review and status of the aerial photography collection,
- Continue the action plan for vegetation classification and mapping,
- Discussions regarding the vegetation sampling for classification,
- Discussions regarding environmental modeling for vegetation mapping, and
- Brief field tour of a few vegetation types.

In between these two meetings, initial field site visits of various vegetation types were conducted by the ANHC under the direction of NatureServe. These initial site visits allowed for the collection of limited field data. The purpose was to grasp the breadth of vegetation types that exist at the BUFF and to identify suitable locations for field crews to collect full-version vegetation plots. The vegetation plots were collected for plant community characterization during the summers of 2006 and 2007 by the University of Arkansas Herbarium. The sampling data were then entered into the NPS PLOTS Database (NatureServe 2005). Analyses were performed, which provided the detailed ecological information necessary to affirm vegetation types at the BUFF and to document them with local descriptors. A key to vegetation types was also produced. In August 2008, NatureServe provided the NPS with an in-depth vegetation classification report. That classification report has since been updated and revised with the vegetation classification products provided by this project report.

Color-infrared (CIR) aerial photographs of the BUFF were collected (as coordinated by the USGS UMESC) at 1:12,000-scale during late October 2006; these photographs provided aerial views for fieldwork and mapping. The objective of this collection was to capture peak color change (leaf phenology) of the hardwood forests for mapping purposes. The UMESC had previously collected a set of CIR aerial photographs during the middle of November 2005, but this photography captured leaf senescence of forests that was too far along for adequate identification of hardwood forest types; a severe storm had passed through the area the week prior to the photo acquisition and accelerated leaf senescence. Although the 2006 photographs were used as the primary set for mapping, the 2005 photographs were used as an ancillary set to better determine conifer components of forests. Both sets of photography were processed into spatially-referenced digital imagery for use in geographic information systems (GIS).

In October 2007, a team from the MCGSC met with an ecologist from ANHC to visit several representative vegetation plots at the BUFF. The purpose was to determine how biophysical factors, such as topographic position, moisture availability, and substrate, can influence the spatial distribution of vegetation types. From an understanding of these biophysical factors, models were produced to attain a preliminary map classification based on Landsat imagery data, USGS digital elevation models, Natural Resources Conservation Service soils data, and the 2006 CIR aerial photography; both the spatially-referenced digital imagery and hard-copy stereo photographs were used. This preliminary map classification provided a first attempt at recognizing what mapping models and object-oriented mapping might provide in support of the vegetation mapping of the BUFF.

In 2009, another meeting was held. Partners—including the NPS BUFF, USGS UMESC, USGS MCGSC, NatureServe, and ANHC—met at the headquarters of the BUFF June 9–10, 2009. The meeting had the following objectives:

- Conduct a workshop to prepare the map classification for map reconnaissance,
- Review and update partners on work completed,
- Discuss the upcoming mapping process by the UMESC,
- Discuss the AA process and final products,
- Discuss functional and logistical support to the mapping and AA field efforts, and
- Discuss the timeline of events and tasks.

The map-classification workshop oriented the mapping team at the UMESC with the completed vegetation classification work produced by NatureServe and the ANHC. A map classification linked to the vegetation types in the NVCS for the BUFF was constructed, along with mapping conventions. Preliminary models were built into these mapping conventions to be tested during the field reconnaissance for mapping. Field reconnaissance for mapping occurred as two efforts in 2009: the first one in June and the second one in September/October. The primary purposes of these field efforts were to correlate vegetation types with their appearances in the aerial photographs and to test environmental models to pinpoint vegetation types that were not discernible via visual inspection of the aerial photos. After the first field effort, the UMESC performed preliminary mapping on select areas in order to verify interpretive decisions and modeling parameters during the second field effort. Results from this practicum accordingly led to the adjustment of mapping conventions and environmental models.

During the fall/winter of 2009 and winter/spring of 2010, the UMESC performed mapping via digital-onscreen, three-dimensional (3D), stereoscopic workflow systems by using GIS software. The mapping was performed by using onscreen photointerpretation of digital imagery that was spatially referenced in GIS. The MCGSC provided a review of the mapping in regards to proper use of the environmental models. A draft version of the vegetation map was completed—a spatial database layer—and prepared it for AA. During the summer of 2010, field crews collected data of stratified and randomly selected sites for evaluating the accuracy of the vegetation map layer. In 2011, an analysis was performed in which the AA data were compared to the vegetation map. Results were tabulated into a contingency matrix.

Ultimately, a geodatabase containing four feature class layers was developed, including the following: vegetation and land cover polygons (showing locations of vegetation types and general land cover features, such as non-vegetated open water), vegetation points (containing vegetation sampling plots and AA sites), 1:12,000-scale CIR aerial photographic centers, and project boundary extent. Included in the geodatabase are several tables providing a suite of supporting information, from classification crosswalks to detailed sampling data. All geospatial products are projected in the Universal Transverse Mercator (UTM), Zone 15, by using the North American Datum of 1983 (NAD83).

Project Boundary Extent

The project boundary extent for the BUFF vegetation mapping project coincides with the park boundary for the BUFF (Figure 10). The total map extent is 37,828.4 ha. As mentioned above, a feature-class layer showing the extent of the project boundary was developed and incorporated into the geodatabase for the BUFF vegetation mapping project.

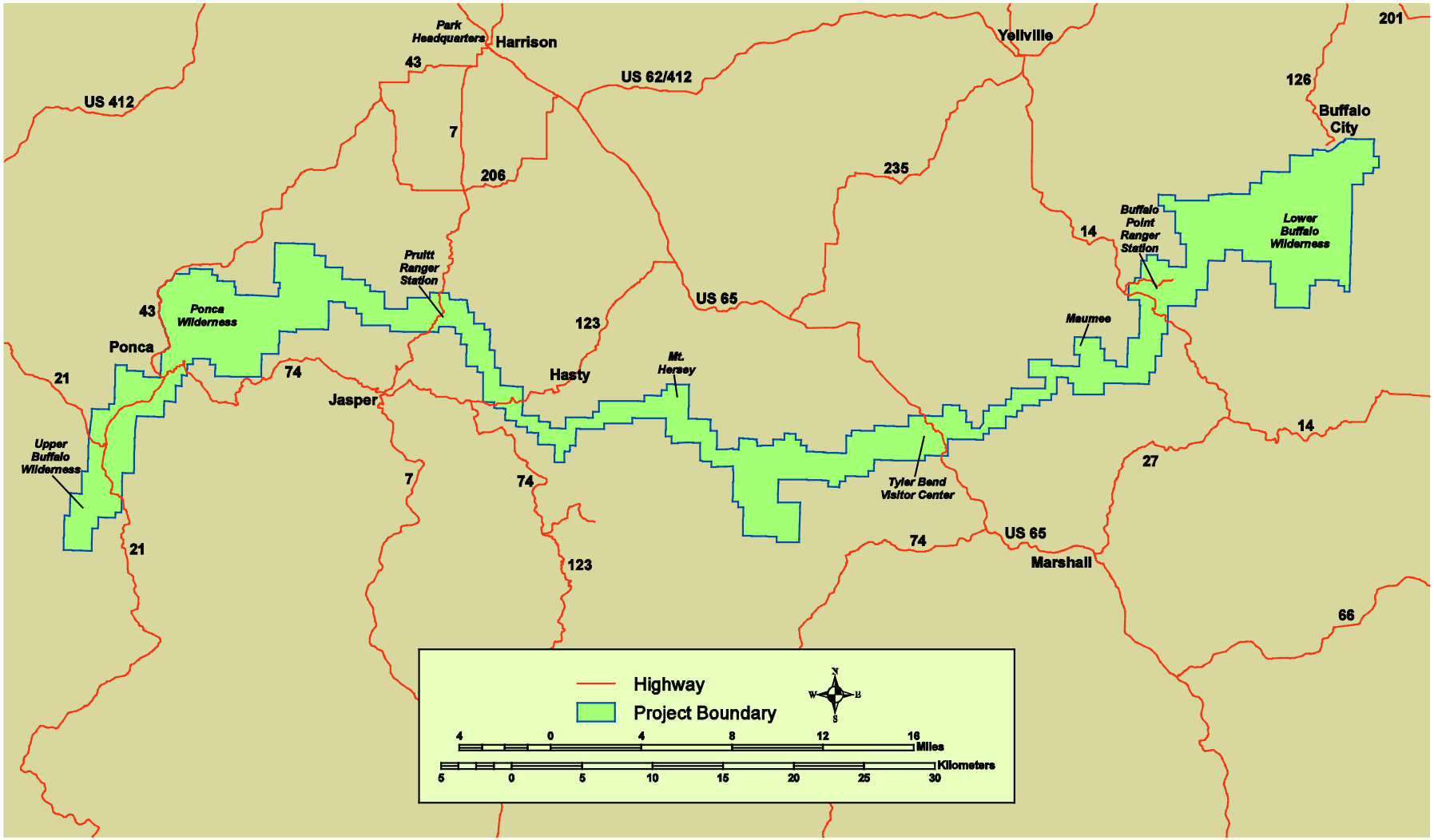


Figure 10. Project boundary for the Buffalo National River (Arkansas) vegetation mapping project.

Aerial Photography

Aerial photographs provide the baseline imagery data for mapping vegetation types and other feature units. Vertical photographs (photographs taken with the aerial camera pointed straight down at the ground) collected with proper overlapping within each flight line permit an interpreter to study the photographs three-dimensionally with a stereoscope (Avery 1978) or, in our case, to view stereo models of digital imagery with a 3D computer monitor. Because ecologic settings are taken into account in mapping vegetation types, the ability to view the aerial photographs in 3D assists the recognition of those ecologic settings.

A variety of film emulsions were available, and Avery (1978) concludes that no single film emulsion serves all purposes. Our aim with collecting aerial photography for the BUFF vegetation mapping project was to capture peak leaf-color change, in order to aid mapping and viewing distinctions between various deciduous forest types.

The original intention for mapping the vegetation of the BUFF was to use traditional methods of viewing hard-copy, diapositive, aerial photographs with the aid of high-precision stereoscopes over light tables. However, since the inception of the BUFF project in 2004, a move to a completely digital workflow involving 3D stereo-viewing had been adopted by the UMESC. Although collecting digital imagery along with camera sensor data (e.g., inertial measurement unit) would have been a better alternative, analog photography had already been collected. Thus, the hard-copy photographs were processed into digital imagery by scanning them and then produced stereo models (needed for viewing the digital images using 3D software).

A set of 1:12,000-scale, CIR aerial photographs was collected on October 28 and 29, 2006. This photography was used as the primary imagery in our photointerpretative mapping. In addition to the 2006 photos, a set of 1:12,000-scale, CIR aerial photographs was collected on November 10, 2005. This photography was intended to be the one use for mapping the BUFF. However, as explained earlier, a severe storm had passed through the area the week prior to photo acquisition. This resulted in large areas of trees without leaves; the ability to identify hardwood forest types from the aerial photos was thereby lost. The 2005 photos were put to use as an ancillary set to reference while mapping from the 2006 photos. Furthermore, ten of the 2005 photos were used to fill a small area that did not get collected with the 2006 photo mission (due to film expenditure). This area is of the southern portion of the Richland Valley within the BUFF. A total of 254 aerial photos were collected with the 2006 photo mission. With the addition of the 10 photos from the 2005 photo mission to fill in the gap from 2006, 264 photos complete the aerial photo coverage of the BUFF for this vegetation mapping project.

To assure stereo viewing and full aerial coverage, both the 2005 and 2006 aerial photo missions were planned with a 60% forward-lap and a 30% side-lap. Contact print sets were produced for fieldwork use by mappers. Diapositives of the CIR set were originally produced for photointerpretative mapping but actually became the medium that was used to scan and orthorectify for 3D mapping and/or for making digital orthophotograph mosaics. Table 4 outlines details of the aerial photography acquired for the BUFF vegetation mapping project.

Table 4. Aerial photography sets for the Buffalo National River (Arkansas) vegetation mapping project.

[CIR, color-infrared]

Photography date	Film type	Scale	Products
November 10, 2005	CIR Transparency (Positive)	1:12,000	Contact Print Diapositive Orthophotograph
October 28–29, 2006	CIR Transparency (Positive)	1:12,000	Contact Print Diapositive Orthophotograph

A feature-class layer locating the centers of the CIR aerial photographs obtained in October 2006 (Figure 11) was produced. This feature class is incorporated into the geodatabase for the BUFF vegetation mapping project. The digital orthophotographic mosaics of both the 2005 and the 2006 aerial photograph sets are also provided as a product for the BUFF vegetation mapping project.

Minimum Mapping Units

The NPS VIP standard minimum mapping unit (MMU) of 0.5 ha was largely applied for mapping. For select map classes, a MMU of 0.25 ha was applied to address management preferences. Also, when vegetation types were found unique to their immediate surroundings (e.g., a rocky open-canopy pine woodland within a closed-canopy oak forest), mapping below the MMU was allowed.

Classification Organization

Throughout this project report and the final products related to the BUFF vegetation mapping project (e.g., the geodatabase), the vegetation classification is organized with the National Vegetation Classification Standard (NVCS), Version 2 (FGDC 2008). In the NVCS, separate categories are provided for natural and cultural vegetation. Typically, areas having 1% or more of their surface area with live vegetation cover are classified within the NVCS. The NVCS excludes non-vegetated natural lands (e.g., sand beaches) and waters (e.g., lakes, rivers). For these, the classification provided by the 2001 National Land Cover Database (Homer et al. 2004) is used.

Throughout this report, the term “vegetation type” is used to reference vegetation classification units in general, at any level of the hierarchy within the NVCS. For example, the *Acer saccharinum* - *Ulmus americana* Forest Association and the Silver Maple - Green Ash - Sycamore Floodplain Group are each treated as a vegetation type.

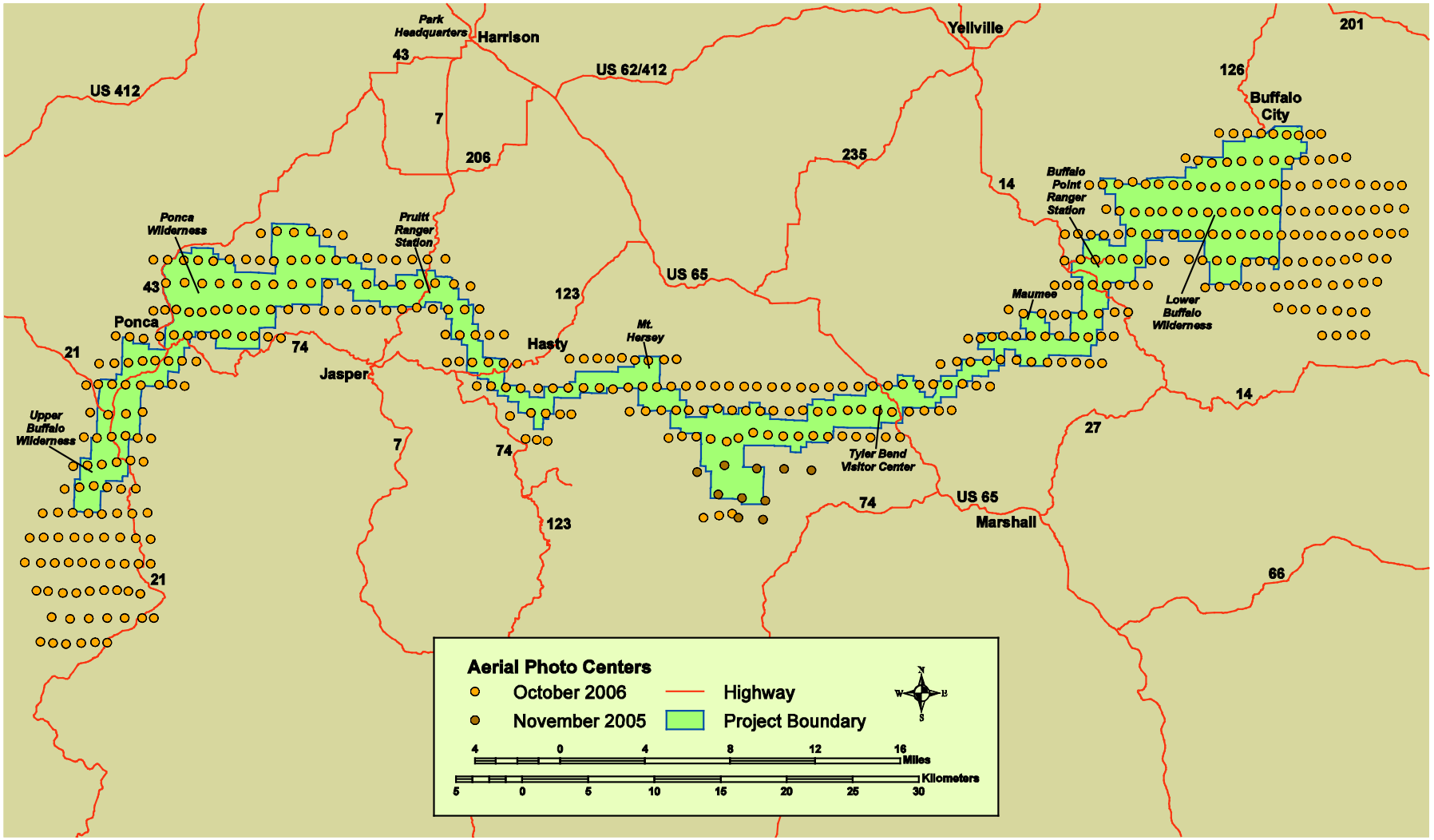


Figure 11. Centers of color-infrared aerial photos (1:12,000-scale) obtained in October 2006 for the Buffalo National River (Arkansas) vegetation mapping project.

Vegetation Classification

Methods

Preliminary Classification

One of the steps in classifying the vegetation of the Buffalo National River (BUFF) was to prepare a preliminary classification report prior to the scoping meeting held at the headquarters of the BUFF in Harrison, Arkansas, March 9–10, 2006. Although this meeting had several purposes (as outlined in the Project Overview section of this report), one of the primary purposes was to kick off the vegetation sampling effort. Although an initial scoping meeting for the BUFF vegetation mapping project was held May 17–19, 2004 (to kick off the vegetation mapping project), the collection of vegetation samples for classification analysis had not yet begun[1].

The preliminary classification report for the BUFF was generated by reviewing all floristic (association and alliance) vegetation types in the National Vegetation Classification Standard (NVCS) attributed to the BUFF. This initial list of floristic types was reviewed by staff from NatureServe and the Arkansas Natural Heritage Commission (ANHC) to remove vegetation types thought unlikely to occur at the BUFF. The resulting preliminary classification report included 35 associations that were documented for the BUFF and were nested within 28 alliances. Before the field season started in 2006, we generated an additional list of potential associations occurring at the BUFF by querying our database for all communities attributed to the Nature Conservancy's Ozarks Ecoregional Planning Unit (ECO38) within the state of Arkansas. We drew upon this larger list of community types for our work at the BUFF to ensure that we collected plot data from every possible community that could exist within the boundary of the BUFF. We initially estimated that there were 50 associations at the BUFF.

Data Collection Preparation

The protocols for the National Park Service (NPS) Vegetation Inventory Program (VIP) suggest that an average of at least three plots per estimated association type from the preliminary classification report should be collected. At the time of the beginning of this project (before the latest VIP guidance), however, we set out with a goal of collecting five plots per community type. The preliminary classification listed 35 confirmed associations in the project area, and initial estimates suggested there would be at least an additional 15 associations found in the study area, adding up to 50 total associations within the BUFF. We established much of our work on this estimated number, which was based on the best possible data available at the time, as we moved forward with the project. Thus, our initial plan was to sample at least 250 plots over the course of two years.

At least 18 communities were identified that were not already documented for the park but that were likely to be found within the BUFF. In addition to targeting the known communities for plot work, these additional community types were a focus of our field work. Our sampling strategy focused on natural community types and on community types that were large enough to be mapped. Although we did place plots in semi-natural types and small scale communities (like

[1] In between the two scoping meetings, we visited various site locations at the BUFF to gain insight of what vegetation types exist at the BUFF and to identify suitable locations for field crews to collect full-version vegetation plots. These initial site visits allowed for the collection of limited field data and insufficient for vegetation analysis for classification.

canebrakes), our strategy of dividing up the landscape for plot placement did not take these community types into account. Instead, these communities were ones that we picked up opportunistically throughout the work or were types that were easily identified and confirmed without quantitative analysis (such as old fields and monocultural stands of trees).

All field sampling was done within the boundaries of the BUFF to avoid any private property. In attempting an inventory of vegetation communities at the BUFF, we faced the problem of finding every vegetation type at the BUFF without knowing where they all were or even exactly what they all were. The limited time available for field work prohibited extensive reconnaissance. Instead, we used available geospatial layers in geographic information systems (GIS), the preliminary vegetation classification, consultation with knowledgeable staff at ANHP and the University of Arkansas-Fayetteville, and the experience of the field crew to guide our sampling effort. Specifically, we used data layers such as slope, aspect, and geology to develop a GIS layer with a set of classification units that most likely corresponded to different vegetation types. This GIS layer was used by field crews to ensure they visited a representative number of plots in each classification "category". Crews were sent to all of these habitats with the idea that in surveying the range of general habitats they would be likely to find all of the fine-scale, association-level vegetation units. By using the preliminary vegetation classification, field teams were able to recognize types that fit existing communities as well as types that clearly did not fit within community types that were listed for the BUFF (new communities). As the field crews learned more about the vegetation landscape at the BUFF and consulted with staff, they were able to locate less common vegetation types.

Field Sampling

The field sampling methodology was adapted from program standards (NatureServe 2004). Details are provided in the program standard document from 2004, though a general summary does appear here.

Plots were placed to represent the character of an entire stand of vegetation. They were usually located at least 20 m from the boundary of another vegetation type to reduce the variability associated with the transition from one vegetation type to another. It was sometimes difficult to determine what constituted the boundary of a unique vegetation type because two adjacent stands may be floristically very similar but separated in the NVCS based on physiognomic criteria (e.g., amount of shrub cover, which may be determined by one or two species).

Plots were square or rectangular and were either 400 m² or 200 m², depending on the dominant physiognomy (Table 5) and constraints such as roads, cliffs, and water. Boundaries of the plots were marked with flags or with measuring tape.

Within each plot, data collectors separated the vegetation into "strata" for the purpose of data collection. Within each stratum, all taxa within the plot area were identified, and the foliar cover of each taxon was estimated by using cover classes. (See Table 6 for cover classes and strata.) The diameter at breast height (DBH) of trees greater than 10 cm wide was recorded as well.

Table 5. Plot sizes used for vegetation plot sampling for the Buffalo National River (Arkansas) vegetation mapping project.

Dominant physiognomy	Plot size	Plot area
Forest to Open Woodland: At least 10% canopy cover of trees.	20 x 20 m	400 m^2
Shrubland: shrubs are dominant, usually forming more than 25% cover or exceeding tree, herb, and nonvascular cover.	10 x 10 m or 20 m x 20m	200 or 400m^2
Herbaceous (e.g., grassland, meadow, marsh): Herbs dominant, usually forming more than 25% cover OR exceeds tree, shrub, and nonvascular cover.	10 x 10 m	200 m^2
Nonvascular (e.g., rock outcrop or cliff): nonvascular cover dominant, usually forming more than 25% cover.	10 x 10 m	200 m^2
Sparse vegetation (e.g., cobble bar): less than 10% total vegetation cover.	10 x 10 m	200 m^2

Table 6. Cover classes and vegetation strata used during vegetation plot sampling for the Buffalo National River (Arkansas) vegetation mapping project.

Cover scales	Vegetation strata
1 Trace	T1 Emergent Canopy:
2 0.1-1%	T2 Main Canopy
3 1-2%	T3 Subcanopy
4 2-5%	S1 Tall Shrubs
5 5-10%	S2 Short Shrubs
6 10-25%	H Herbaceous (field layer, including tree seedlings)
7 25-50%	N Non-vascular
8 50-75%	V Vine/liana
9 75-95%	
10 >95%	

Environmental information, such as slope, aspect, soil texture, and evidence of disturbance, was recorded. Locational information, including spatial coordinates, was obtained by using a global positioning system (GPS), and written directions to the plot were provided. Digital photographs were taken of the plot to provide additional information and to assist in classifying the plot. Finally, the field crew gave the plot a provisional classification name. Figure 12 shows an example of a vegetation plot. For an example of a plot form, see Appendix A: Plot Sampling Form.



Figure 12. A vegetation plot for the Buffalo National River (Arkansas) vegetation mapping project.

Data Analyses, Results, and Discussion

Field teams collected plot information and data from late May to August 2006 and from June and July 2007, by sampling a total of 250 plots throughout the park (Figure 13). All field data were entered into the NPS PLOTS Database Version 2.0, a Microsoft Access database designed for the NPS VIP (NatureServe 2005).

To analyze vegetation patterns and classify types, we partitioned the plot data by using non-metric multi-dimensional scaling (NMS) ordination and Flexible Beta clustering techniques with PC-ORD 5.0 software (McCune and Mefford 1999). Some potential groupings of plots were also compared by using indicator species, both manually and by using indicator species analysis techniques.

Our quantitative analyses were focused on a few groups that were determined prior to the analysis work. For the BUFF, we initially split off all plots that were clearly cultivated, early successional, or semi-natural from the matrix prior to running the cluster analysis since these types of communities do not lend themselves well to automated analysis. We then created three separate groupings for cluster analysis. One grouping consisted of all plots that clearly fit into glade, barren, cliff, and talus communities. A second grouping consisted of all riparian and floodplain communities. The final grouping included all other plots, mostly hardwood, mixed, and conifer dominated uplands. We then used cluster analysis to further subdivide the groups. From the results of these analyses, we began separating groups of plots at the association scale and reran cluster analyses as needed on subsets of data. In the end, each association could be represented by one to several plots. Dominant canopy species were of primary importance in dividing the forest types, and understory species (shrubs and herbaceous) helped parse those types into associations.

By using the results of both NMS and Flexible Beta analyses, classification rules were generated to assign plots to associations. Typically, those stands in which hardwoods or conifers contributed between 25% and 75% were classified as mixed and were assigned to a type based on the dominant conifer in the canopy. Those stands that had less than 25% canopy cover from hardwoods were assigned based on the dominant conifer; those with less than 25% canopy cover from conifer species were assigned based on the mixture of hardwoods found in the canopy. These rules were also applied during the mapping of NVCS types. Despite these rules, possible confusion could arise in the case of a predominantly evergreen canopy (e.g. of shortleaf pine) over a predominantly deciduous subcanopy, which might be difficult to distinguish from a stand with emergent pines over deciduous trees (e.g. oaks). Some of these stands were interpreted as mixed. This fuzzy approach was necessary since there is not always a clear line between what constitutes the canopy versus what constitutes the subcanopy or understory in some stands.

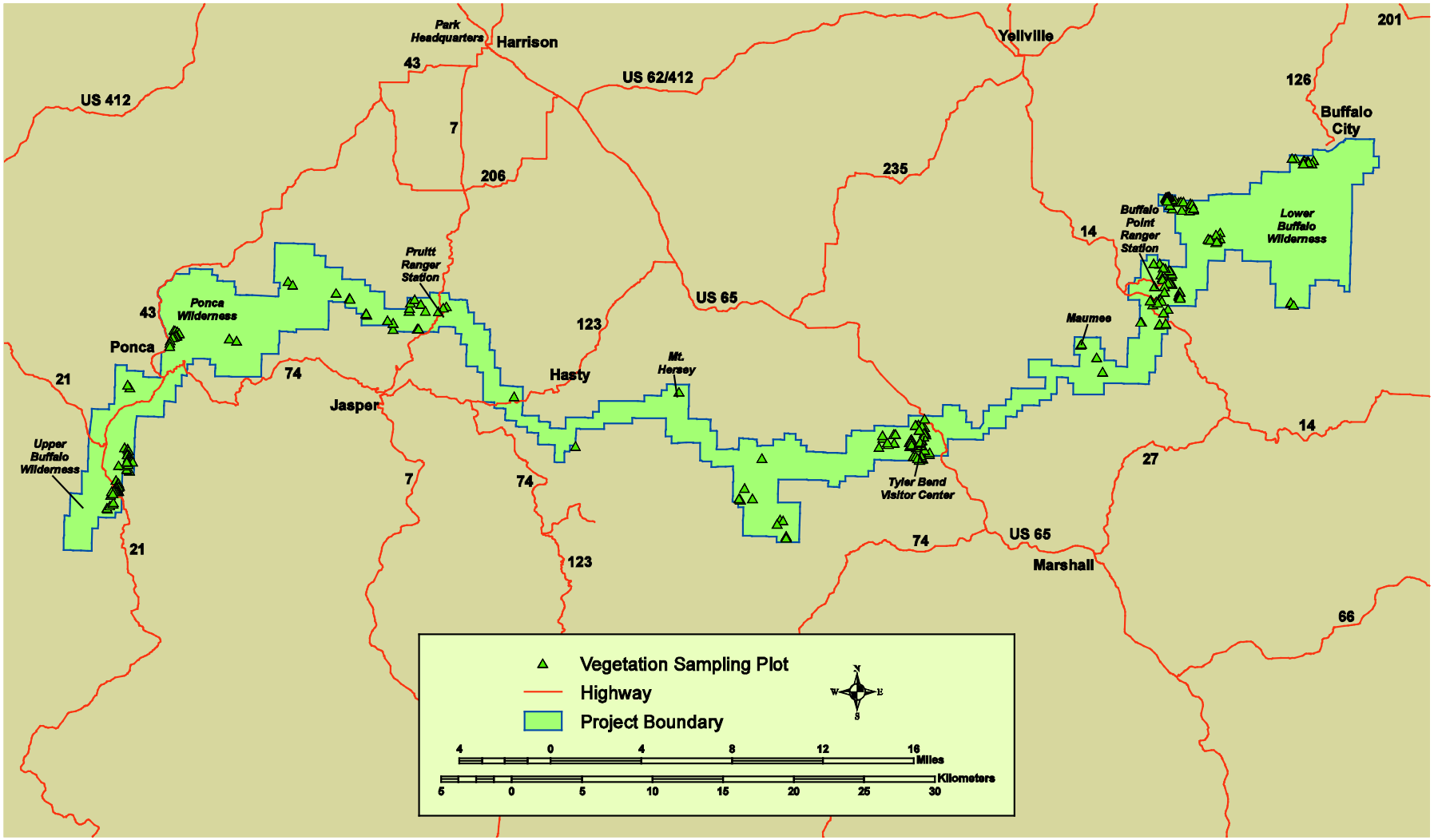


Figure 13. Locations of the 250 vegetation plots sampled for the Buffalo National River (Arkansas) vegetation mapping project.

Once we had created the draft version of association groupings, we then submitted the plot assignments to vegetation experts at NatureServe and ANHC for final review, comments, and changes wherein the quantitative analysis results were not logical. From this analysis and subsequent review, we were able to assign community names to all plots at the BUFF.

Through the analyses of our 2006 and 2007 sampling plots, we confirmed 40 plant communities (associations in the NVCS), with each association type having an average of 6.25 plots. Individual association types had plot counts ranging from one to 27. We recognized that there were additional communities, especially open wetland and semi-natural communities, that were present in the park that were not sampled, so we also included those communities in the classification and key, even though we had no plot data for them at that point. Rare and semi-natural associations tended to have the fewest plots, whereas the most common and/or most variable types had the most. Some key examples of community types are described below:

- The White Oak - Northern Red Oak - Sugar Maple - Bitternut Hickory / Northern Spicebush Forest (27 plots) was the most sampled hardwood association in the BUFF. This forest is highly variable in terms of composition but has a fairly consistent closed-forest structure.
- The Ozark Ashe's Juniper Glade Woodland (5 plots) is a globally rare (G2?) but locally more common community type characterized by a very open canopy with sparse Ashe's juniper (*Juniperus ashei*). This type primarily occurs on exposed dolomite rock areas; however, it does occasionally occur on limestone rock areas as well. This community type can have a very diverse herbaceous and short shrub layer.
- The River Birch - Sycamore Forest (5 plots) is an example of a riparian forest that occurs in spots along river/creek stretches within the BUFF. This type is generally a closed forest, though because of disturbance or intense flooding, some examples may have a more open canopy. River birch (*Betula nigra*) and sycamore (*Platanus occidentalis*) are consistently present, but a wide range of other tree canopy species may be co-dominant or present in these stands.

During the time between the collection of plot data and the collection of accuracy assessment (AA) data (summer 2010), we continued to revise and update the classification, particularly by using the field reconnaissance performed for the vegetation mapping (summer and fall of 2009). During these reconnaissance efforts, we observed vegetation corresponding to several association types for which no plot sampling data were collected; we then worked at incorporating those associations into the classification. In all, we recognized an additional 16 associations that had not been included in the original plot data. Most of these plots were either ones we could not sample using our techniques (open water dominated communities) or were semi-natural types where we felt enough data already existed globally for those types to negate the need for additional plot data (see Table 7 for a list of the 16 associations that are without plot data). In the end, the classification document and the key to vegetation types were updated to include the 56 association types that we considered present in the BUFF.

Table 7. List of floristic vegetation types of the Buffalo National River (Arkansas) that were officially documented after the vegetation-plot data collection in 2007.

[NVCS, National Vegetation Classification Standard, Version 2 (FGDC 2008); CEGL, Community Element Global]

NVCS Association Name	NVCS CEGL Code
Shortleaf Pine Plantation	CEGL007169
Loblolly Pine Plantation	CEGL007179
Successional Black Locust Forest	CEGL007279
Red-cedar - Pine - Elm Successional Ozark Forest	CEGL007816
Osage-orange Successional Forest	CEGL006627
Early-Successional Shortleaf Pine Forest	CEGL003327
Southern Green Ash - Elm - Sugarberry Forest	CEGL002427
Bulrush - Cattail - Bur-reed Shallow Marsh	CEGL002026
Southern Cattail Marsh	CEGL004150
Interior Alder Shrubland	CEGL003894
Ozark Riverine Gravel Flats	CEGL007012
Cultivated Meadow	CEGL004048
Watershield Pond	CEGL004527
Water-willow Rocky Bar and Shore	CEGL004286
Midwest Limestone - Dolostone Talus	CEGL002308
Interior Highlands Sandstone Talus	CEGL002309

As with any classification project, there were a number of association types that were easily confused with one another both in the field and as part of the quantitative vegetation classification process. Some examples are explained below.

Nine associations fit within the South-Central Interior Oak Forest group in the NVCS. Of those, many are distinguished from one another by presence of species that are representative of either acidic or alkaline soils. Since the gradient between alkaline and acidic soils is rarely abrupt, there are bands of the landscape that could be considered intermediate between the two, thus causing some confusion in terms of the primary call of the community. Confusion between the White Oak - Red Oak Dry-Mesic Acidic Forest (CEGL002067) and the White Oak - Mixed Oak Dry-Mesic Alkaline Forest (CEGL002070) was particularly acute.

As noted previously in this section, the boundary between a “mixed” stand and a “deciduous” stand of trees can be fuzzy at times. In many instances for Interior Highlands Shortleaf Pine - Oak Dry-Mesic Forest (CEGL007489), Ozark/Ouachita Shortleaf Pine - Oak Dry Woodland (CEGL002393), and Interior Highlands Shortleaf Pine - Black Oak Forest (CEGL002401), the final call as to whether the plot could be considered a mixed or deciduous type was made by looking closely at the plot data to discern whether the conifers were in the overstory or in the understory, or vice versa. This distinction helped us classify plots, but we admit that the distinction between the Interior Highlands Shortleaf Pine - Oak Dry-Mesic Forest and some of the deciduous oak community types can be a difficult one to quantify.

Our biggest obstacle in vegetation classification at the BUFF, however, was access and terrain. The BUFF is an extremely rugged park surrounded on most sides by lands of the U.S. Department of Agriculture Forest Service with limited roads. In most cases, accessing areas near the canyon is only feasible by access points or by canoe and is virtually impossible to accomplish

on foot in one day. However, our field crews, in conjunction with NPS staff, were very adept at finding the best access points so that we could access representative areas throughout the park.

In all, a total of 56 natural/semi-natural association types from the NVCS were identified for the BUFF. Table 8 lists the vegetation types and includes the number of times each type was sampled within a vegetation plot. In addition to those listed, we also assigned some plots only to a group or to a broad category. We considered 20 of the AA sites to be cobble bars that did not necessarily have vegetation but that could be considered part of Ozark Riverine Gravel Flats (CEGL007012) for map assessment purposes. In addition, we assigned three AA sites to the Eastern North American Freshwater Marsh Group (G.125) and 36 AA sites to the Southeastern Old Field Group (G.583), which coincided with the level of classification applied in the mapping.

Table 8. List of associations of the Buffalo National River (Arkansas) with number of field observations.

[NVCS, National Vegetation Classification Standard, Version 2 (FGDC 2008); CEGL, Community Element Global; AA, Accuracy Assessment]

NVCS Group	NVCS Association Name	NVCS CEGL Code	Observations (Full Plots / AA plots)
Forest to Open Woodland Class			
Shortleaf Pine-Oak Forest			
	Interior Highlands Shortleaf Pine - Oak Dry-Mesic Forest	CEGL007489	11 / 88
	Ozark/Ouachita Shortleaf Pine - Oak Dry Woodland	CEGL002393	4 / 6
	Interior Highlands Shortleaf Pine - Black Oak Forest	CEGL002401	7 / 13
	Interior Highlands Shortleaf Pine / Blueberry Forest	CEGL002400	1 / 15
Appalachian and Interior Mesophytic Forest			
	Ozark Rich Beech - Mixed Hardwood Forest	CEGL007823	13 / 20
	White Oak - Red Oak - Sugar Maple Mesic Forest	CEGL002058	27 / 7
Southeast Conifer & Hardwood Forest			
	Shortleaf Pine Plantation	CEGL007169	0 / 7
	Loblolly Pine Plantation	CEGL007179	0 / 2
Northern & Central Hardwood & Conifer Ruderal Forest			
	Ozark Honey-locust - Black Walnut Woodland	CEGL004345	3 / 14
	Successional Black Locust Forest	CEGL007279	0 / 2
Southeast Hardwood & Conifer Ruderal Forest			
	Successional Eastern Red-cedar Forest	CEGL007124	9 / 16
	Red-cedar - Pine - Elm Successional Ozark Forest	CEGL007816	0 / 6
	Interior Mid- to Late- Successional Sweetgum - Oak Forest	CEGL007217	7 / 14
	Osage-orange Successional Forest	CEGL006627	0 / 0
	Early-Successional Shortleaf Pine Forest	CEGL006327	0 / 13
Oak - Sweetgum Floodplain Forest			
	Floodplain Canebrake	CEGL003836	1 / 24
	Ouachita-Ozark Small Stream Hardwood Forest	CEGL007826	11 / 40
	Bur Oak - Shumard Oak Mixed Bottomland Forest	CEGL004544	2 / 2

NVCS Group	NVCS Association Name	NVCS CEGL Code	Observations (Full Plots / AA plots)
Silver Maple - Green Ash - Sycamore Floodplain			
	Southern Interior Box-elder Riparian Forest	CEGL004690	6 / 23
	Box-elder Floodplain Forest	CEGL005033	2 / 55
	Silver Maple - Elm Forest	CEGL002586	2 / 2
	River Birch - Sycamore Small River Floodplain Forest	CEGL002086	5 / 6
	Ash - Oak - Sycamore Mesic Bottomland Forest	CEGL002410	6 / 26
	Southern Green Ash - Elm - Sugarberry Forest	CEGL002427	0 / 5
Northeastern & North-Central Oak - Hickory Forest			
	Black Oak - White Oak - Hickory Forest	CEGL002076	13 / 7
South-Central Interior Oak Forest			
	Ozark Red-cedar - Hardwood Forest	CEGL004803	6 / 58
	White Oak - Red Oak Dry-Mesic Acidic Forest	CEGL002067	19 / 35
	White Oak - Mixed Oak Dry-Mesic Alkaline Forest	CEGL002070	18 / 61
	White Oak - Post Oak / Bluestem Ozark Woodland	CEGL002150	11 / 6
	Ozark-Ouachita Dry-Mesic - White Oak - Black Oak - Hickory Forest	CEGL004270	10 / 35
	Eastern Oklahoma Dry-Mesic Oak - Hickory Forest	CEGL004543	5 / 14
	Blackjack Oak Xeric Scrub	CEGL002425	1 / 1
	Midwest Post Oak - Blackjack Oak Forest	CEGL002075	2 / 27
	Ozark/Ouachita Post Oak - Blackjack Oak / Little Bluestem Woodland	CEGL002149	5 / 3
Chinkapin Oak - Shumard Oak - Blue Ash Alkaline Forest			
	Ozark Ashe's Juniper Glade Woodland	CEGL007833	5 / 5
	Ozark Ashe's Juniper Clifftop Woodland	CEGL004672	3 / 3
	Red-cedar Alkaline Bluff Woodland	CEGL002426	1 / 17
	Chinkapin Oak - Ash / Little Bluestem Woodland	CEGL002143	7 / 19
	Chinkapin Oak - Shumard Oak Ozark Forest	CEGL004602	1 / 19
Shrubland & Grassland Class			
Eastern North American Freshwater Marsh			
	Bulrush - Cattail - Bur-reed Shallow Marsh	CEGL002026	0 / 3
	Southern Cattail Marsh	CEGL004150	0 / 0
Northern & Central Acidic Glade			
	Ozark Sandstone Glade	CEGL002242	1 / 10
Northern & Central Alkaline Glade			
	Ozark Limestone Glade	CEGL002251	2 / 7
	Ozark Dolomite Glade	CEGL002398	6 / 6
	Ozark Basic Sandstone Glade	CEGL007814	10 / 18
Interior Plateau Seepage Fen			
	Ozark Fen	CEGL002404	1 / 0
Northern & Central Riverscour Wetland			
	Carolina Willow Ozark Shrubland	CEGL007064	3 / 22
	Interior Alder Shrubland	CEGL003894	0 / 1
	Witch-hazel - Dogwood Gravel Wash	CEGL003898	2 / 12

NVCS Group	NVCS Association Name	NVCS CEGL Code	Observations (Full Plots / AA plots)
Eastern North American River Shoreline			
	Ozark Riverine Gravel Flats	CEGL007012	0 / 0
Southeastern Old Field			
	Successional Broomsedge Vegetation	CEGL004044	1 / 12
	Cultivated Meadow	CEGL004048	0 / 16
Aquatic Wetland Vegetation			
Eastern North American Freshwater Aquatic Vegetation			
	Watershield Pond	CEGL004527	0 / 4
	Water-willow Rocky Bar and Shore	CEGL004286	0 / 0
Rock Vegetation			
Eastern North American Talus & Bluff			
	Midwest Limestone - Dolostone Talus	CEGL002308	0 / 0
	Interior Highlands Sandstone Talus	CEGL002309	0 / 0

All association types within the NVCS that we identified at the BUFF are described in Appendix B: Descriptions of Vegetation Types. A key to vegetation types is provided in Appendix C: Field Key to Vegetation Types, which can be used in concert with the vegetation descriptions. A listing of plant species identified from the vegetation plot samples and AA sites is provided in Appendix D: List of Plant Species.

Vegetation Mapping

Introduction

Prior to 2009, the majority of efforts employed for the Buffalo National River (BUFF) vegetation mapping project involved various coordination meetings between partners, as well as the development of the vegetation classification by NatureServe and Arkansas Natural Heritage Commission (ANHC). In addition, some preliminary map classification and mapping work was performed by the U.S. Geological Survey (USGS) Mid-Continent Geographic Science Center (MCGSC) to test imagery sources and environmental data sets for modeling purposes. In 2009, the USGS Upper Midwest Environmental Science Center (UMESC) began as the primary mapping team with coordinated assistance from the MCGSC for further environmental modeling efforts and subsequent review of the mapping in regards to proper use of the environmental models. What follows is the vegetation mapping methods and results beginning in 2009.

Methods

Mapping vegetation of the BUFF involved five primary steps, including the following: (1) preliminary map classification, (2) field reconnaissance, (3) map classification, (4) photointerpretation, and (5) digital map automation and database development. Although these steps occurred sequentially, they overlap to some degree.

Preliminary Map Classification

Prior to field reconnaissance, it is advantageous for photointerpreters to become familiar with any known vegetation types to be mapped. Having a map classification in hand with initial mapping conventions, as preliminary as it might be, promotes continuity from the classifier to the mapper at the onset of the vegetation mapping process. Additionally, this preliminary step puts in the hands of the photointerpreters the foundations of a working map classification, yet one that will undoubtedly go through many updates and revisions throughout the vegetation mapping process.

In August 2008, NatureServe had completed a vegetation classification based on the analyses of vegetation sampling data that had been collected for the BUFF vegetation mapping project. A key to the vegetation types was also produced. This provided the grounds to develop a preliminary map classification prior to conducting field reconnaissance for mapping. In June 2009, we met as classifiers and mappers at the headquarters of the BUFF in Harrison, Arkansas. The purposes of this meeting were multiple[2]; however, a primary objective was to conduct a map-classification workshop to prepare the mappers from the UMESC for subsequent field efforts and mapping. Participants included staff from the National Park Service (NPS) BUFF, NatureServe, ANHC, USGS MCGSC, and USGS UMESC.

The map-classification workshop introduced the mapping team at the UMESC with the 2008 version of the vegetation classification. Ecologists from NatureServe and the ANHC, provided succinct descriptions of vegetation types as the mappers from the UMESC and MCGSC took note and discussed how vegetation types might best be represented in a workable map

[2] One purpose of the meeting was to update the mappers from the UMESC on the efforts already implemented for the BUFF vegetation mapping project. Another purpose was to discuss and plan out future efforts that were remaining, including vegetation mapping and accuracy assessment.

classification. Pertinent details about the vegetation types that might aid in making interpretive decisions were assembled into mapping conventions. A preliminary map classification linked to the vegetation types in the National Vegetation Classification Standard (NVCS) for the BUFF was constructed along with mapping conventions. Preliminary models were built into these mapping conventions to be tested during the field reconnaissance for mapping.

Field Reconnaissance

In preparation to map vegetation types, we spent several days in the field investigating ground conditions and comparing them to the set of color-infrared (CIR) aerial photographs (the set of photos acquired for photointerpretative mapping[3]). This process is necessary, as Hershey and Befort (1995) explain, because CIR photography is not consistent enough between photo sets to allow a species to be depicted precisely. Film batch, printing process, sun angle, light intensity, shadow, and exposure can all affect the appearance. Hence, in spite of our experience as photointerpreters, we engaged in ground verification of the aerial photographs. Ultimately, field reconnaissance helped us correlate photo signatures of the vegetation (appearances of vegetation on the aerial photographs) with vegetation on the ground, particularly when performed as a team of vegetation mappers and classifiers (Figure 14).



Figure 14. Field reconnaissance to correlate aerial photo signatures with ground vegetation at the Buffalo National River, Arkansas.

[3] The primary set of aerial photographs used for mapping the BUFF was collected during October 28–29, 2006, at a scale of 1:12,000. An earlier set (with the same parameters as the 2006 set) was also acquired during November 10, 2005, and was used as an ancillary set for mapping. More information on the aerial photography sets that were collected for the BUFF vegetation mapping project is provided in the Project Overview section of this report.

Field reconnaissance also allowed photointerpreters to become more familiar with the local ecology of vegetation types, which is important when applying ecologic concepts to photointerpretative mapping. Where photointerpreters discovered limitations to interpreting vegetation types by using aerial photographs, environmental models were developed and tested to determine if vegetation types could be consistently separated by environmental elements. These models were produced by the team of ecologists and mappers with the use of environmental data sets, including soil pH, geology, and topography for slope and aspect to detect solar radiation (amount of exposure to sunlight). The prior work conducted by staff from the MCGSC provided a useful footing to springboard from in regards to environmental models and the use of available data sets of the BUFF lands.

The field efforts for mapping occurred as two separate trips in 2009: one in June and the other in September/October. In these field efforts, a team of mappers and classifiers (ecologists) ensured correct assessment of vegetation types, in order to subsequently promote correct assignment during photointerpretative mapping. The mappers became familiar with the vegetation and local ecology as they learned the structural, floristic, and habitat characteristics of the vegetation encountered in the field and compared those characteristics to the appearance of the vegetation on the photos.

The photo contact prints were taken into the field, with notes recorded onto photo jackets. Field notes might consist of the map-class assignment, if known. Other notes, to promote proper perspective of species composition (e.g., heterogeneous versus monotypic forest stand), might include comments regarding significant species. In essence, we would build a photo-signature model on which to base our decisions during photointerpretative mapping. In addition, estimated tree heights were occasionally recorded to give a perspective for applying the physiognomic height modifier during mapping.

The initial set of environmental models was constructed from decisions made from the first field effort. Furthermore, the map classification and mapping conventions were adjusted based on what was learned during the first field effort. Between the first and second field efforts, the environmental models were produced for use in geographic information systems (GIS). Mappers from the UMESC performed preliminary mapping on select, diverse areas to test (during the second field effort) the interpretive decisions using the map classification, mapping conventions, and environmental models; this field-testing effort is called map verification. From the results of the map verification, adjustments were made accordingly to the map classification and conventions, as well as to the environmental models.

Much of the landscape of the BUFF was covered by the mappers during the field reconnaissance, and much variability in the vegetation types was found. In some cases, it was determined by the team of classifiers that some vegetation types existed that had not been represented by the vegetation plots. These vegetation types were accordingly added to the vegetation and map classifications.

Map Verification

Preliminary mapping was performed and was verified during the second field reconnaissance effort (September/October of 2009). As described above, the purpose of map verification for the BUFF vegetation mapping project was to test the map classification and conventions, as well as

the environmental models. Results from the field testing influenced whether mapping conventions and/or environmental models were found to need adjusting prior to the mapping effort.

Three separate locations—each characterized by diverse vegetation types—were visited for map verification throughout the BUFF. A location was chosen for each of the three management districts at the BUFF: Upper River, Middle River, and Lower River. These locations include the following: Boxley Valley, Tyler Bend, and an extended area around Toney Bend. The CIR aerial photos from October 2006 were interpreted by the mapper, who applied the mapping conventions and environmental models produced from the first field reconnaissance effort for mapping (June 2009).

Actual map verification sites were selected while in the field during the second field reconnaissance effort. Figure 15 shows the locations of the individual map verification sites. A team of mappers and classifiers[4] collected coordinate location information using global positioning system (GPS) devices. From data sets in GIS, environmental gradient data were also acquired, including: aspect, slope, topographic position, slope curvature, solar radiation, geology, soil type, soil pH, and general comments regarding each site. The key (the then current 2009 version) to the vegetation types of the BUFF was used to determine the vegetation type of the area. The vegetation type was compared to the map class assigned by the mapper. A total of 34 sites were visited for map verification. Appendix E: Map Verification Table provides a table, which was originally generated by the USGS MCGSC and which shows the results of the map verification effort. We produced a feature-class layer that shows locations of the map verification sites and incorporated it into the geodatabase for the BUFF vegetation mapping project.

[4] The mapper and classifier team consisted of staff from USGS UMESC, USGS MCGSC, NatureServe, and ANHC.

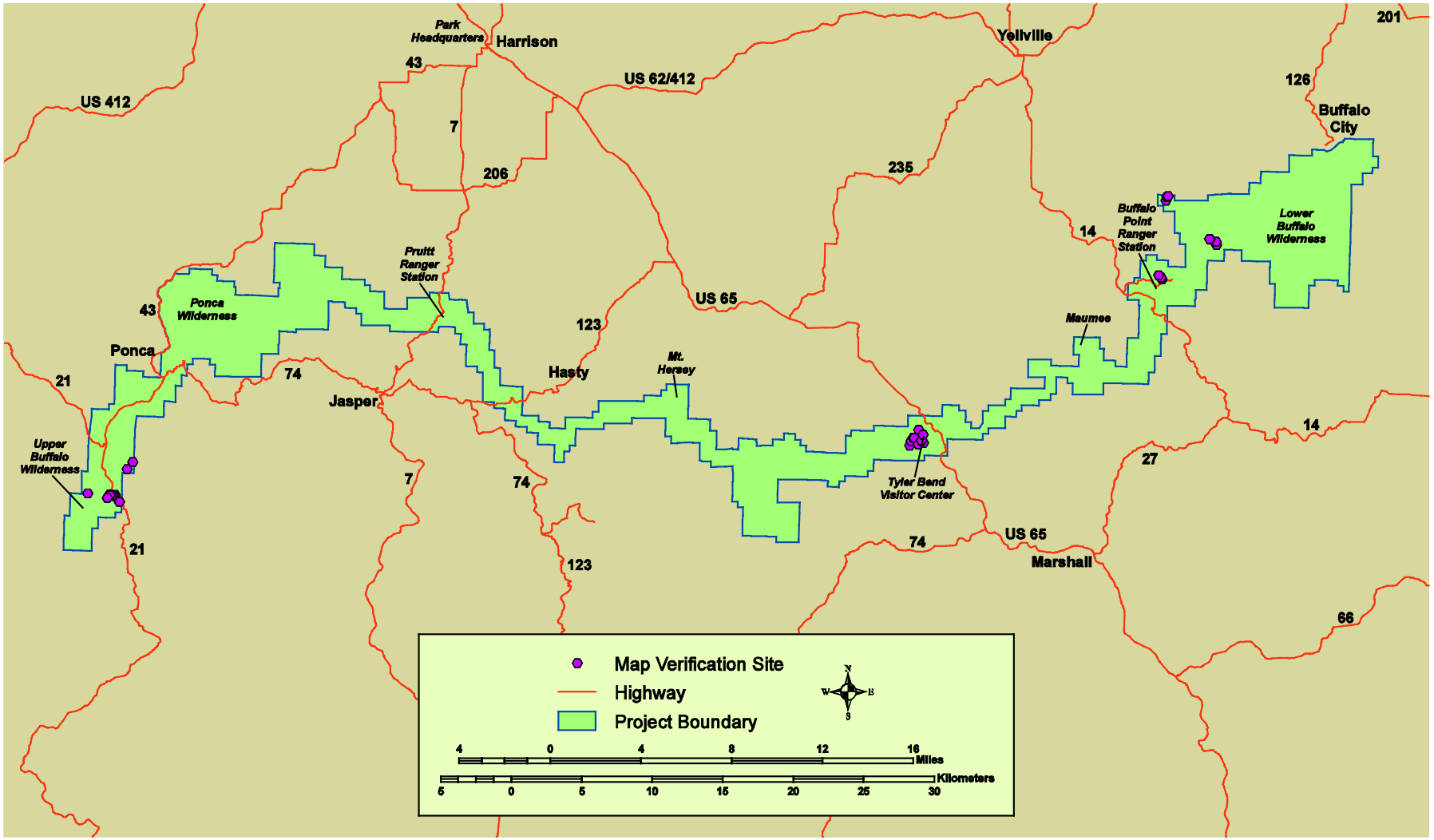


Figure 15. Locations of map verification sites visited for the Buffalo National River (Arkansas) vegetation mapping project.

Map Classification

The map classification and protocols are based on existing classification systems. A map class represents a definable feature (e.g., a vegetation type) that can be distinguished on an aerial photograph and/or by use of an environmental model. We linked map classes representing natural/semi-natural vegetation types to association types, as identified by NatureServe, in the NVCS. Some vegetation types could not be assigned to an association-level type because of disturbance (e.g., human or beaver activities). For the vegetation types of those map classes, we assigned the appropriate group-level type further up the hierarchy in the NVCS. Cultural vegetation (e.g., roads, residence, parks) were linked to the upper echelon of the NVCS and then further described with special modifiers by using the classification system of the National Land Cover Database (NLCD) 2001 (Homer et al. 2004).[5] For non-vegetation features (e.g., open-water bodies), we derived map classes corresponding closely with the classification from NLCD 2001.

For those map classes directly representing association types in the NVCS, we assigned the map-class name with the common name established in the classification database of NatureServe (e.g., Ozark Red-cedar - Hardwood Forest). For those map classes representing more than one association type in the NVCS, we derived a comparable name for the map class (e.g., Ozark Ashe's Juniper Woodland map-class name for the collective associations of Ozark Ashe's Juniper Glade Woodland and Ozark Ashe's Juniper Clifftop Woodland). For map classes representing types at the group level in the NVCS and for non-vegetation features, we derived generic names to describe the features.

We continually updated the map classification throughout the entire mapping effort. Each field endeavor, including the map verification effort, revealed new information, prompting us to modify map classes and their definitions. We also made revisions as the vegetation classification developed toward its completion. Furthermore, as aerial photos were interpreted, new issues arose, which forced us to either redefine, expand, or polish map-class definitions. Throughout the project, we adjusted the map classification as needed, so that it might best reflect the vegetation classification we knew of at the time.

We derived a map-class code for each map class for ease of assigning information to map polygons and for use as a short-hand language amongst team members. Each polygon was assigned a map-attribute code, which is a code constructed of the following three sections: (1) a single map-class code, (2) a set of physiognomic modifier codes, and (3) a special modifier code for oak-hardwood forests (to identify modified forests from a selective harvest of tree species). Modifier codes are used only when applicable. A hyphen separates the three code systems (e.g., [map-class code]-[set of physiognomic modifier codes]-[special modifier code]).

A map-class code is made up of three alpha characters and represents an independent map class. Each map-class code begins with the first alpha representing the major physiognomic characteristic, as follows:

[5] The NLCD 2001 is a land cover database produced by the Multi-Resolution Land Characterization 2001 Consortium.

- F = Forest,
- W = Woodland,
- S = Shrubland,
- H = Herbaceous Vegetation,
- V = Sparse Vegetation,
- C = Cultural Developed, and
- N = Non-NVCS.

The subsequent two alpha characters for each map class loosely represent the map-class name (e.g., AS for alder swamp, WM for wet meadow, DV for developed).

The physiognomic modifier codes are strings of alpha and numeric characters and, when applicable, follow the map-class codes. These physiognomic modifiers provide additional information describing the physiognomic characteristics of the vegetation within each mapped polygon. Table 9 lists the physiognomic modifiers and the special modifier code we used for mapping the BUFF.

Table 9. Physiognomic and special modifiers assigned to polygons during photointerpretation for the Buffalo National River (Arkansas) vegetation mapping project.

Category	Modifier	Meaning
Coverage density (Applied to all vegetation map classes)	1 2 3	Closed Canopy/Continuous (60–100% cover) Open Canopy/Discontinuous (25–60% cover) Dispersed-Sparse Canopy (10–25% cover)
Coverage pattern (Applied to all vegetation map classes)	A B C D	Evenly Dispersed Clumped/Bunched Gradational/Transitional Regularly Alternating
Height (Applied to woody terrestrial vegetation map classes only)	1 2 3 4 5	>30 m 15–30 m 5–15 m 0.5–5 m <0.5 m
Modified (altered) (Applied only to oak-hardwood forests modified or altered by selective harvesting of tree species)	A	Modified (altered) Oak-Hardwood Forest

An example of a map-attribute code is "FOM-2B3-A." This code describes given map polygons as the White Oak - Red Oak - Sugar Maple Mesic Forest (FOM) map class, which represents the *Quercus alba* - *Quercus rubra* - *Acer saccharum* - *Carya cordiformis* / *Lindera benzoin* Forest Association (CEGL002058) in the NVCS. This code also indicates that the vegetation has a coverage density of 25–60%, a coverage pattern that is clumped/bunched, and an average tree height of 5–15 m throughout the mapped polygon. The last modifier tagged on the end (A) serves as an indicator provided by the interpreter who thought that the oak-hardwood forest had

received some type of selective harvesting of tree species in the past. Presenting this series of map classification and physiognomic information can enhance the interpretation of the map layer for managers and researchers, particularly when introducing other geospatial data sets.

Environmental Models

Several environmental models were developed in order to separate and map several vegetation types that were not discernible via visual inspection of the aerial photos. They are as follows:

- Solar Radiation Model – Mixed Oak Forest: for separating dry-xeric, dry-mesic, and mesic oak forest types, and for separating dry-xeric and dry-mesic pine-oak forest types,
- Soil pH Model – Oak Forest: for separating acidic and calcareous (alkaline) dry-mesic oak forest types,
- Soil pH Model – Herbaceous Glade: for separating acidic and calcareous herbaceous glade types,
- Location/Geology/Soil pH/Slope Model – Cedar/Juniper: for separating eastern red-cedar and Ashe's juniper types, and
- Riverine Model – Riparian Dynamics: for separating riparian hardwood forests within large and small river systems and within high and low dynamic systems.

Not all of the models were successful at distinguishing vegetation types, according to the results of the accuracy assessment (AA) study for this vegetation mapping project. The following provides a brief description on the construction, use, and success of each environmental model.

Solar Radiation Model – Mixed Oak Forest

A solar radiation model was developed as an attempt to separate a suite of oak and pine-oak forest types across a moisture gradient. The model was used to separate oak forest types into three groupings with the following site-moisture categories: dry-xeric, dry-mesic, and mesic. The model was also used to separate pine-oak forests into two groupings with the following site-moisture categories: dry-xeric and dry-mesic. The model was produced with a 10 m resolution digital elevation model and with an April 20 insolation date and was classified into 20 classes. The procedure was based on a technique by Fu and Rich (1999) for modeling solar radiation at landscape scales. An earlier version of the model was produced with a July 1 insolation date; however, this date provided less favorable results after testing, during the map verification effort.

The results of the AA study indicate that this solar radiation model provided less than favorable input to achieve accuracy standards in separating out moisture gradients associated with both the oak and the pine-oak forest types. We provide more discussion regarding this in the Accuracy Assessment section of this report.

Soil pH Model – Oak Forest

A soil pH model was developed as an attempt to separate the suite of oak forest types into two pH groupings: acidic and calcareous (alkaline). This model was applied to the dry-mesic oak and pine-oak forest types; dry and dry-xeric sites at the BUFF are typically acidic in nature and mesic sites are typically calcareous. A soil pH of $\geq$6.2 was considered calcareous, whereas a soil pH of $<$6.2 was considered acidic. Breaking points between acidic and calcareous of 6.0 and 6.5 were also explored yet with less favorable results.

As with the solar radiation model, the results of the AA study indicate that this soil pH model provided less than favorable input to achieve accuracy standards in separating acidic and calcareous groupings of these dry-mesic oak and pine-oak forest types. We provide more discussion regarding this in the Accuracy Assessment section of this report.

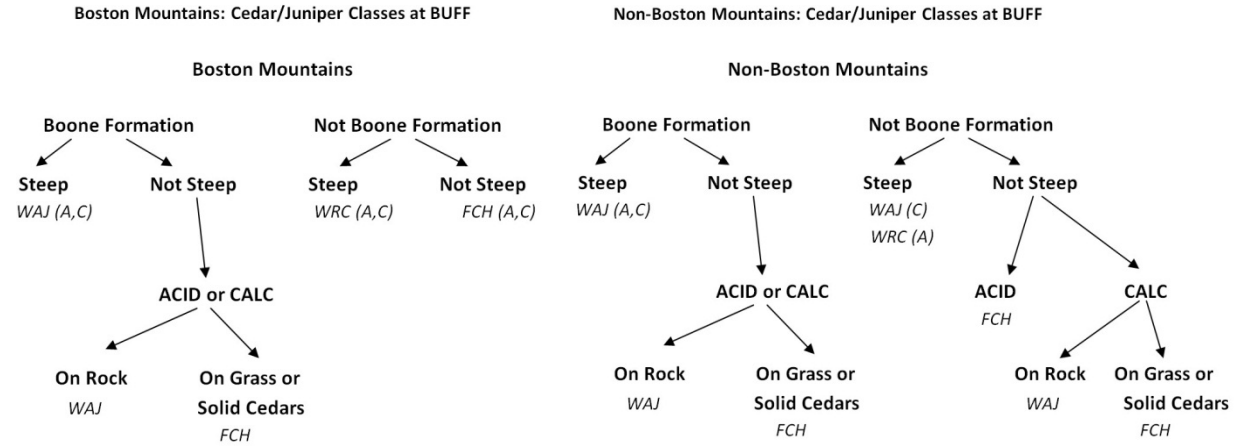
Soil pH Model – Herbaceous Glade

A soil pH model was developed as an attempt to separate the herbaceous glade types into two major groupings: acidic and calcareous (alkaline). This model was applied to all the herbaceous glade types. As with the pH model for the mixed oak forests, a soil pH of ≥6.2 was considered calcareous, whereas a soil pH of <6.2 was considered acidic. Breaking points between acidic and calcareous of 6.0 and 6.5 were explored yet, as with the mixed oak forests, with less favorable results. We provide further explanation on the use of this model in Appendix F: Descriptions of Map Classes.

The results of the AA study indicate that this soil pH model provided favorable input to achieve accuracy standards in separating acidic and calcareous herbaceous glade types.

Location/Geology/Soil pH/Slope/Physiognomic Model – Cedar/Juniper

A model was developed as an attempt to separate the series of cedar/juniper forest and woodland types at the BUFF. This model was based on several inputs and was constructed as a decision tree, by including location, geology formation, soil pH, steepness of slope, and vegetation physiognomies. This model is easiest described by the diagrams provided in Figure 16.



[A and ACID, Acidic; C and CALC, Calcareous]

Figure 16. Diagrams of the decision trees that display the Location/Geology/Soil pH Model – Cedar/Juniper.

A soil pH of ≥6.2 was considered calcareous, whereas a soil pH of <6.2 was considered acidic. The diagrams in Figure 16 show the decision process between all three map classes: Ozark Ashe's Juniper Woodland (WAJ), Red-cedar Alkaline Bluff Woodland (WRC), and Ozark Red-cedar - Hardwood Forest (FCH). We provide more clarity on the use of the decision trees in Appendix F: Descriptions of Map Classes.

The results of the AA study indicate that this complex cedar/juniper model provided some success to achieve accuracy standards in separating acidic and calcareous cedar/juniper types; that is, some map classes met accuracy whereas others did not. We provide more discussion regarding this in the Accuracy Assessment section of this report.

Riverine Model–River Size/Energy

A special mapping-convention model was derived to separate the suite of riparian forest types into four map classes, including large river/dynamic, large river/stable, small river/dynamic, and small river/stable. This mapping strategy required us to first decide whether a given riparian forest was part of either a large or small river system and then to determine whether it was occurring within either a dynamic (high energy) or stable (low energy) portion of the riverine system.

Prior to mapping, it was thought that each of several riparian hardwood forest types would fit nicely into one of the four groupings listed above. For each forest occurring within a large-river or small-stream environment, energy flow of water was assessed according to the position (level) of the forest within the terrace. Forests positioned within the scouring channel portions of rivers and streams were mapped as one of the "dynamic" map classes, whereas those positioned above the rivers and streams on higher terraces were mapped as one of the "stable" map classes.

Inherent to this model was a greater level of subjectivity than with the other environmental models described above. The results of the AA study indicate that this riverine model provided less than favorable input to achieve accuracy standards in separating the suite of riparian forest types. We provide more discussion on this in the Accuracy Assessment section of this report.

Photointerpretation and Mapping

The vegetation mapping of the BUFF was performed at the UMESC via digital-onscreen three-dimensional (3D) stereoscopic workflow systems that used GIS software. The mapping team performed onscreen photointerpretation of digital imagery that was spatially referenced in GIS. The environmental models were used to further separate vegetation types where visual interpretation was either limited or not possible. Staff from the MCGSC reviewed the mapping to ensure proper use of the environmental models. A draft version of the vegetation map—a spatial database layer—was then prepared for AA. The vegetation map was then adjusted according to the initial results from the analysis of the AA, in order to meet accuracy criteria set by the NPS VIP. In other words, map classes for which there was mapping confusion and low accuracy results were merged together to attain a higher accuracy.

We produced the digital imagery used for the onscreen photointerpretation from scanned images of the 1:12,000-scale CIR aerial photographs that were acquired in October 2006 for the BUFF vegetation mapping project. We generated stereo models for the aerial images to attain 3D viewing on 3D computer monitors. (Stereo models contain georeference information in an associated text file which is used to display pairs of unreferenced images on 3D monitors. We used LPS Core software by ERDAS, Inc., for the building of stereo models.)

Two individuals performed the actual interpretive mapping for the BUFF vegetation mapping project; however, each used a different 3D mapping system. The first system was a passive stereo method. It used two rigidly-mounted monitors with a pane of polarized glass in-between.

Polarized glasses were worn with one lens blocking the light from the upper monitor, which displayed the left stereo pair, and the other lens blocking the light from the lower monitor, which displayed the right stereo pair. This allowed the same area to be viewed from slightly different perspectives and gave depth perception. For the passive stereo method, the stereo models were imported into PurView (ESRI Canada, Inc.) for 3D viewing and editing. The second system was an active stereo method. It used tiny liquid crystals that can be turned off and on 60 times a second. These glasses were synchronized to an LCD computer monitor that is capable of a 120 Hz refresh rate. The 3D viewing program then displayed a stereo pair of aerial images to each eye alternately 60 times a second—too fast to be detected. This allowed the viewer to see the same areas from two different perspectives and creates the perception of depth. For the active stereo method, the stereo models were imported into Stereo Analyst for ArcGIS (ERDAS, Inc.) for 3D viewing and editing.

Mapping occurred from fall of 2009 to spring of 2010. The image interpretation was performed on high-resolution 3D computer monitors using either passive (polarized) or active (shutter) stereo-viewing glasses, depending on the 3D mapping system that was used. We used ArcGIS (Version 9.3, Environmental Systems Research Institute [ESRI], Redlands, California) as the GIS software platform for the onscreen digital mapping. Since stereo models contain georeferencing information, map polygons are georeferenced as they are digitally drawn onscreen. We stored the polygon vector data using ArcGIS as shapefiles, which were projected in Universal Transverse Mercator (UTM), Zone 15, by using the North American Datum of 1983 (NAD83).

The map classification, mapping conventions, and environmental models were tweaked to accord with both the field reconnaissance efforts for mapping and the results of the map verification and were, thus, prepared for use in mapping.

For the image interpretation, standard photo signature characteristics were applied—including texture, color, pattern, and position in the landscape—to guide placement of polygons. In addition to photo signature characteristics, an understanding by the mappers of the environmental distribution of the vegetation types helped mappers to not only identify types but also to properly place polygon boundaries. For each polygon, the appropriate map-class code and modifier codes (collectively, the map-attribute code) were applied.

To help visualize the conifer component within hardwood-dominant forest stands, occasionally the 2005 set of CIR aerial photographs (scale of 1-12:000) were viewed by the mappers using stereoscopes over light tables. The 2005 set was collected November 10, 2005, a week after a severe storm had passed through the area and had moved leaf senescence too far along for adequate identification of hardwood forest types. (Note: ten of the 2005 aerial photos were used to fill a small area that did not get collected by the 2006 photo mission). Furthermore, historical aerial photos were also occasionally viewed by the mapper using stereoscope. These historical photos, provided by staff at the BUFF, were black and white photos that dated from the 1930s. A knowledge of past land-use activities can provide the mapper with insight on the successional stage of forest stands under interpretation.

The environmental models were employed by the mappers in an attempt to distinguish and map separately vegetation types that were not discernible from visual inspection of the aerial photos.

The MCGSC provided a review of the mapping in regards to proper use of the environmental models. Vegetation plot sampling data was also used as "virtual" data to enhance the interpretive decisions.

We routinely applied the standard minimum mapping unit (MMU) of 0.5 ha set by the NPS VIP. For select map classes, we applied a MMU of 0.25 ha to address management preferences. Also, when vegetation types were found unique to their immediate surroundings (e.g., a rocky open-canopy pine woodland within a closed-canopy oak forest), we allowed for mapping below the MMU.

Map Layer Development

At this stage, the map layer would have only map-attribute codes assigned to each polygon. To assign meaningful information to each polygon (e.g., map-class names, modifier definitions, links to NVCS types), we produced a feature-class table, along with other supportive tables, and subsequently related them together within a geodatabase using ArcGIS (Version 10, ESRI, Redlands, California). This geodatabase also links the map to other feature-class layers produced from this project, including vegetation sample plots, map verification sites, AA sites, aerial photo locations, and project boundary extent. A geodatabase provides access to a variety of interlocking data sets, is expandable, and equips resource managers and researchers with a powerful GIS tool. All geospatial products are projected in the UTM, Zone 15, by using the NAD83.

Results

Map Classes

After the AA analysis, 29 map classes—of which 26 represent vegetation types at various levels in the NVCS—represent the BUFF. At the time of mapping, 39 map classes existed for mapping the BUFF, of which 36 map classes represented vegetation types at various levels in the NVCS. The AA study showed that several map classes had been confused with each other in various ways during the mapping; several map classes received results below the accuracy standard for the NPS VIP. Therefore, most of those map classes with low accuracies were merged together. Various reasons are recognized for the confusion between the map classes, including a breakdown of the environmental models and ecological mapping conventions. We provide further details regarding this in the AA section of this report.

Of the resulting 29 map classes, 26 represent 54 natural/semi-natural vegetation types within the NVCS; of the 54 vegetation types, 52 are association-level types and 2 are group-level types. From this vegetation mapping project, we recognized a total of 56 association types. Four of these associations are not represented by any one map class because they were too small to map; they are captured by various map classes throughout the map. Of the remaining three map classes, one represents a cultural vegetation type (developed lands) within the NVCS, and two represent non-vegetation features (open-water bodies).

Of the 26 map classes representing natural/semi-natural vegetation types within the NVCS, 13 each represent a single vegetation type, whereas the remaining half each represent multiple vegetation types, many representing a pair of associations. Other map classes represent from three to seven vegetation types.

We prefer to present the map classification in concert with the hierarchy of the NVCS, Version 2 (FGDC 2008). Yet because several map classes have association types that overarch several hierarchical boundaries in the NVCS, we found it was not feasible to present the map classification in conjunction with the NVCS hierarchy as we might otherwise have wished. Instead, we loosely present the map classification primarily via an ad-hoc physiognomic and/or hydrologic presentation and provide a crosswalk to the vegetation types in the NVCS. Table 10 lists the map classification from a map class perspective. Further, to show how the map classes fit within the NVCS, Table 11 lists the map classes as they relate to the NVCS. Note, however, that map classes representing more than one vegetation type appear multiple times in Table 11.

Table 10. Map Classification and crosswalk to vegetation types in the National Vegetation Classification Standard, Version 2 (FGDC 2008), for the Buffalo National River (Arkansas) vegetation mapping project.

Note: the bold headings within the table (above the map classes) are primarily ad-hoc physiognomic and/or hydrologic categories to help organize the map classes; this category system is an ad-hoc arrangement and not part of any recognized classification hierarchy; however, all map classes except for those under the Open Water category represent vegetation types within the National Vegetation Classification Standard.

[CEGL, Community Element Global; NLCD, National Land Cover Database; NVCS, National Vegetation Classification Standard]

Map Class Code - Name	Vegetation Association* Common Name	Vegetation Association* Scientific Name	CEGL Code*
Conifer Forest			
FSP - Shortleaf Pine Forest			
	Early-Successional Shortleaf Pine Forest	*Pinus echinata* Early-Successional Forest	CEGL006327
	Interior Highlands Shortleaf Pine / Blueberry Forest	*Pinus echinata* / *Vaccinium* (*arboreum*, *pallidum*, *stamineum*) Forest	CEGL002400
Conifer - Hardwood Forest			
FPO - Shortleaf Pine - Oak Forest			
	Interior Highlands Shortleaf Pine - Oak Dry-Mesic Forest	*Pinus echinata* - Quercus (*alba, rubra*) / *Vaccinium* (*arboreum*, *pallidum*) / *Schizachyrium scoparium* - *Chasmanthium sessiliflorum* - *Solidago ulmifolia* Forest	CEGL007489
	Interior Highlands Shortleaf Pine - Black Oak Forest	*Pinus echinata* - *Quercus velutina* - *Quercus stellata* / *Vaccinium* spp. Forest	CEGL002401
FCH - Ozark Red-cedar - Hardwood Forest			
	Ozark Red-cedar - Hardwood Forest	*Juniperus virginiana* - *Quercus* (*alba*, *stellata*) - *Carya texana* Forest	CEGL004803
Oak - (Hardwood) Forest			
FDO - Mixed Oak - (Hardwood) Dry Forest			
	Black Oak - White Oak - Hickory Forest	*Quercus velutina* - *Quercus alba* - *Carya* (*glabra*, *ovata*) Forest	CEGL002076
	Chinquapin Oak - Shumard Oak Ozark Forest	*Quercus muehlenbergii* - *Quercus shumardii* Forest	CEGL004602
	White Oak - Red Oak Dry-Mesic Acidic Forest	*Quercus alba* - *Quercus rubra* - *Carya* (*alba*, *ovata*) / *Cornus florida* Acidic Forest	CEGL002067
	White Oak - Mixed Oak Dry-Mesic Alkaline Forest	*Quercus alba* - *Quercus rubra* - *Quercus muehlenbergii* / *Cercis canadensis* Forest	CEGL002070

Map Class Code - Name	Vegetation Association* Common Name	Vegetation Association* Scientific Name	CEGL Code*
	Ozark-Ouachita Dry-Mesic - White Oak - Black Oak - Hickory Forest	*Quercus alba* - *Quercus velutina* - *Carya alba* / *Desmodium nudiflorum* Ozark Forest	CEGL004270
	Eastern Oklahoma Dry-Mesic Oak - Hickory Forest	*Quercus falcata* - *Carya alba* - *Carya ovata* Forest	CEGL004543
	Midwest Post Oak - Blackjack Oak Forest	*Quercus stellata* - *Quercus marilandica* - *Carya* (*glabra*, *texana*) / *Vaccinium arboreum* Forest	CEGL002075
Mesic Hardwood Forest			
FBH - Ozark Rich Beech - Mixed Hardwood Forest			
	Ozark Rich Beech - Mixed Hardwood Forest	*Fagus grandifolia* - *Quercus rubra* - *Tilia americana* var. *caroliniana* / *Magnolia tripetala* / *Podophyllum peltatum* Forest	CEGL007823
FOM - White Oak - Red Oak - Sugar Maple Mesic Forest			
	White Oak - Red Oak - Sugar Maple Mesic Forest	*Quercus alba* - *Quercus rubra* - *Acer saccharum* - *Carya cordiformis* / *Lindera benzoin* Forest	CEGL002058
Successional Forest			
FPP - Pine Plantation Forest			
	Shortleaf Pine Plantation	*Pinus echinata* Planted Forest	CEGL007169
	Loblolly Pine Plantation	*Pinus taeda* Planted Forest	CEGL007179
FRS - Ruderal Eastern Red-cedar - (Pine) Forest			
	Successional Eastern Red-cedar Forest	*Juniperus virginiana* var. *virginiana* - (*Quercus* spp.) Forest	CEGL007124
	Red-cedar - Pine - Elm Successional Ozark Forest	*Juniperus virginiana* var. *virginiana* - *Pinus echinata* - *Ulmus alata* / *Rhus glabra* Forest	CEGL007816
FDX - Ruderal Hardwood Forest			
	Interior Mid- to Late-Successional Sweetgum - Oak Forest	*Liquidambar styraciflua* - *Quercus* (*alba*, *falcata*) Forest	CEGL007217
	Osage-orange Successional Forest	*Maclura pomifera* Semi-natural Forest	CEGL006627
	Ozark Honey-locust - Black Walnut Woodland	*Gleditsia triacanthos* - *Juglans nigra* / *Bromus secalinus* - *Poa pratensis* Successional Woodland	CEGL004345
	Successional Black Locust Forest	*Robinia pseudoacacia* Forest	CEGL007279
Bottomland Hardwood Forest			
FRH - Riparian Hardwood Forest			
	Southern Interior Box-elder Riparian Forest	*Acer negundo* - (*Platanus occidentalis*, *Populus deltoides*) Forest	CEGL004690
	Silver Maple - Elm Forest	*Acer saccharinum* - *Ulmus americana* Forest	CEGL002586
	River Birch - Sycamore Small River Floodplain Forest	*Betula nigra* - *Platanus occidentalis* Forest	CEGL002086
	Ash - Oak - Sycamore Mesic Bottomland Forest	*Fraxinus pennsylvanica* - *Celtis* spp. - *Quercus* spp. - *Platanus occidentalis* Bottomland Forest	CEGL002410

Map Class Code - Name	Vegetation Association* Common Name	Vegetation Association* Scientific Name	CEGL Code*
	Southern Green Ash - Elm - Sugarberry Forest	*Fraxinus pennsylvanica - Ulmus americana - Celtis laevigata / Ilex decidua* Forest	CEGL002427
	Ouachita-Ozark Small Stream Hardwood Forest	*Liquidambar styraciflua* - (*Quercus alba*, *Acer saccharum*) / *Carpinus caroliniana* / *Lindera benzoin* Forest	CEGL007826
	Bur Oak - Shumard Oak Mixed Bottomland Forest	*Quercus macrocarpa - Quercus shumardii - Carya cordiformis / Chasmanthium latifolium* Forest	CEGL004544
FBF - Box-elder Floodplain Forest			
	Box-elder Floodplain Forest	*Acer negundo* Forest	CEGL005033
Conifer Woodland			
WAJ - Ozark Ashe's Juniper Woodland**			
	Ozark Ashe's Juniper Glade Woodland	*Juniperus ashei / Cotinus obovatus / Carex eburnea - Rudbeckia missouriensis* Woodland	CEGL007833
	Ozark Ashe's Juniper Clifftop Woodland	*Juniperus ashei* Ozark Clifftop Woodland	CEGL004672
WRC - Red-cedar Alkaline Bluff Woodland**			
	Red-cedar Alkaline Bluff Woodland	*Juniperus virginiana* Alkaline Bluff Woodland	CEGL002426
Conifer - Hardwood Woodland			
WPO - Ozark/Ouachita Shortleaf Pine - Oak Dry Woodland			
	Ozark/Ouachita Shortleaf Pine - Oak Dry Woodland	*Pinus echinata - Quercus stellata - Quercus marilandica / Schizachyrium scoparium* Woodland	CEGL002393
Oak - (Hardwood) Woodland			
WCO - Chinquapin Oak - Ash / Little Bluestem Woodland			
	Chinkapin Oak - Ash / Little Bluestem Woodland	*Quercus muehlenbergii - Fraxinus* (*quadrangulata*, *americana*) / *Schizachyrium scoparium* Woodland	CEGL002143
WOD - Mixed Oak Dry Woodland			
	White Oak - Post Oak / Bluestem Ozark Woodland	*Quercus alba - Quercus stellata - Quercus velutina / Schizachyrium scoparium* Woodland	CEGL002150
	Blackjack Oak Xeric Scrub	*Quercus marilandica / Vaccinium arboreum / Danthonia spicata* Scrub Woodland	CEGL002425
	Ozark/Ouachita Post Oak - Blackjack Oak / Little Bluestem Woodland	*Quercus stellata - Quercus marilandica - Quercus velutina - Carya texana / Schizachyrium scoparium* Woodland	CEGL002149
Successional Shrubland			
SMX - Ruderal Shrubland			
	Southeastern Old Field Group	Southeastern Old Field Group	G583
Bottomland Shrubland			
SCB - Floodplain Canebrake**			
	Floodplain Canebrake	*Arundinaria gigantea* ssp. *gigantea* Shrubland	CEGL003836

Map Class Code - Name	Vegetation Association* Common Name	Vegetation Association* Scientific Name	CEGL Code*
SHA - Interior Alder Shrubland			
	Interior Alder Shrubland	*Alnus serrulata* Interior Shrubland	CEGL003894
SGB - Riverine Gravel Bar Shrubland**			
	Witch-hazel - Dogwood Gravel Wash	*Hamamelis vernalis* - *Cornus obliqua* - *Hypericum prolificum* Shrubland	CEGL003898
	Carolina Willow Ozark Shrubland	*Salix caroliniana* Temporarily Flooded Ozark Shrubland	CEGL007064
Herbaceous Glade			
HSG - Ozark Sandstone Glade**			
	Ozark Sandstone Glade	*Schizachyrium scoparium* - *Aristida dichotoma* - *Croton willdenowii* / Lichens Wooded Herbaceous Vegetation	CEGL002242
HCG - Herbaceous Calcareous Glade**			
	Ozark Basic Sandstone Glade	*Quercus stellata* - (*Pinus echinata*) / *Vaccinium arboreum* / *Andropogon gerardii* - *Symphyotrichum patens* var. *patentissimum* Wooded Herbaceous Vegetation	CEGL007814
	Ozark Limestone Glade	*Schizachyrium scoparium* - *Bouteloua curtipendula* - *Rudbeckia missouriensis* - *Mentzelia oligosperma* Wooded Herbaceous Vegetation	CEGL002251
	Ozark Dolomite Glade	*Schizachyrium scoparium* - *Sorghastrum nutans* - *Bouteloua curtipendula* - *Rudbeckia missouriensis* - *Hedyotis nigricans* Wooded Herbaceous Vegetation	CEGL002398
Herbaceous Field			
HMX - Ruderal Herbaceous Field			
	Successional Broomsedge Vegetation	*Andropogon virginicus* var. *virginicus* Herbaceous Vegetation	CEGL004044
	Cultivated Meadow	*Lolium* (*arundinaceum*, *pratense*) Herbaceous Vegetation	CEGL004048
Herbaceous Wetland			
HMM - Herbaceous Marsh & Wet Meadow			
	Southeastern Ruderal Wet Meadow & Marsh Group	Southeastern Ruderal Wet Meadow & Marsh Group	G557
	Bulrush - Cattail - Bur-reed Shallow Marsh	*Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation	CEGL002026
	Southern Cattail Marsh	*Typha latifolia* Southern Herbaceous Vegetation	CEGL004150
HFA - Watershield Pond			
	Watershield Pond	*Brasenia schreberi* Eastern Herbaceous Vegetation	CEGL004527
Gravel Bar Sparse Vegetation			
VRG - Ozark Riverine Gravel Flats**			
	Ozark Riverine Gravel Flats	Ozark Riverine Cobble - Gravel Flats Sparse Vegetation	CEGL007012

Map Class Code - Name	Vegetation Association* Common Name	Vegetation Association* Scientific Name	CEGL Code*
Cultural			
CDV - Developed Area			CEGLNLCD21 CEGLNLCD22 CEGLNLCD23 CEGLNLCD24
Open Water (Non-NVCS)			
NSR - Stream & River			CEGLNLCD11
NWP - Open Water Pond			CEGLNLCD11

*Unless otherwise noted.
**A minimum mapping unit of 0.25 ha was applied to these map classes during mapping.

Table 11. Map classification set into the hierarchy of the National Vegetation Classification Standard, Version 2 (FGDC 2008), for the Buffalo National River (Arkansas) vegetation mapping project.

[CEGL, Community Global Element; NVCS, National Vegetation Classification Standard; NLCD, National Land Cover Database]

Map-class Code	Map-class Name
1. FOREST TO OPEN WOODLAND CLASS	
1.B.1.Na. Southeastern North American Warm Temperate Forest Division	
M305. Southeastern North American Ruderal Forest & Plantation Macrogroup	
G029. Southeast Conifer & Hardwood Plantation Group	
Pinus echinata Planted Forest Association (CEGL007169)	
FPP*	Pine Plantation Forest
Pinus taeda Planted Forest Association (CEGL007179)	
FPP*	Pine Plantation Forest
G031. Southeast Hardwood & Conifer Ruderal Forest Group	
Juniperus virginiana var. *virginiana* - (*Quercus* spp.) Forest Association (CEGL007124)	
FRS*	Ruderal Eastern Red-cedar - (Pine) Forest
Juniperus virginiana var. *virginiana* - *Pinus echinata* - *Ulmus alata* / *Rhus glabra* Forest Association (CEGL007816)	
FRS*	Ruderal Eastern Red-cedar - (Pine) Forest
Liquidambar styraciflua - *Quercus* (*alba*, *falcata*) Forest Association (CEGL007217)	
FDX*	Ruderal Hardwood Forest
Maclura pomifera Semi-natural Forest Association (CEGL006627)	
FDX*	Ruderal Hardwood Forest
Pinus echinata Early-Successional Forest Association (CEGL006327)	
FSP*	Shortleaf Pine Forest
1.B.2.Na. Eastern North American Cool Temperate Forest Division	
M153. Central Mesophytic Hardwood Forest Macrogroup	
G020. Appalachian & Interior Mesophytic Forest Group	
Fagus grandifolia - *Quercus rubra* - *Tilia americana* var. *caroliniana* / *Magnolia tripetala* / *Podophyllum peltatum* Forest Association (CEGL007823)	
FBH	Ozark Rich Beech - Mixed Hardwood Forest
Quercus alba - *Quercus rubra* - *Acer saccharum* - *Carya cordiformis* / *Lindera benzoin* Forest Association (CEGL002058)	
FOM	White Oak - Red Oak - Sugar Maple Mesic Forest

Map-class Code	Map-class Name
M012. Central Oak-Hardwood & Pine Forest Macrogroup	
G158. Northeastern & North-Central Oak - Hickory Forest Group	
Quercus velutina - *Quercus alba* - *Carya* (*glabra*, *ovata*) Forest Association (CEGL002076)	
FDO*	Mixed Oak - (Hardwood) Dry Forest
M013. Eastern North American Ruderal Forest & Plantation Macrogroup	
G030. Northern & Central Hardwood & Conifer Ruderal Forest Group	
Gleditsia triacanthos - *Juglans nigra* / *Bromus secalinus* - *Poa pratensis* Successional Woodland Association (CEGL004345)	
FDX*	Ruderal Hardwood Forest
Robinia pseudoacacia Forest Association (CEGL007279)	
FDX*	Successional Hardwood Forest
M016. Southern Hardwood & Pine Forest Macrogroup	
G601. Chinkapin Oak - Shumard Oak - Blue Ash Alkaline Forest Group	
Juniperus ashei / *Cotinus obovatus* / *Carex eburnea* - *Rudbeckia missouriensis* Woodland Association (CEGL007833)	
WAJ*	Ozark Ashe's Juniper Woodland
Juniperus ashei Ozark Clifftop Woodland Association (CEGL004672)	
WAJ*	Ozark Ashe's Juniper Woodland
Juniperus virginiana Alkaline Bluff Woodland Association (CEGL002426)	
WRC	Red-cedar Alkaline Bluff Woodland
Quercus muehlenbergii - *Fraxinus* (*quadrangulata*, *americana*) / *Schizachyrium scoparium* Woodland Association (CEGL002143)	
WCO	Chinkapin Oak - Ash / Little Bluestem Woodland
Quercus muehlenbergii - *Quercus shumardii* Forest Association (CEGL004602)	
FDO*	Mixed Oak - (Hardwood) Dry Forest
G012. Shortleaf Pine - Oak Forest Group	
Pinus echinata - *Quercus* (*alba*, *rubra*) / *Vaccinium* (*arboreum*, *pallidum*) / *Schizachyrium scoparium* - *Chasmanthium sessiliflorum* - *Solidago ulmifolia* Forest Association (CEGL007489)	
FPO*	Shortleaf Pine - Oak Forest
Pinus echinata - *Quercus stellata* - *Quercus marilandica* / *Schizachyrium scoparium* Woodland Association (CEGL002393)	
WPO	Ozark/Ouachita Shortleaf Pine - Oak Dry Woodland
Pinus echinata - *Quercus velutina* - *Quercus stellata* / *Vaccinium* spp. Forest Association (CEGL002401)	
FPO*	Shortleaf Pine - Oak Forest

Map-class Code	Map-class Name
	Pinus echinata / *Vaccinium* (*arboreum*, *pallidum*, *stamineum*) Forest Association (CEGL002400)
FSP*	Shortleaf Pine Forest
	G159. South-Central Interior Oak Forest Group
	Juniperus virginiana - *Quercus* (*alba*, *stellata*) - *Carya texana* Forest Association (CEGL004803)
FCH	Ozark Red-cedar - Hardwood Forest
	Quercus alba - *Quercus rubra* - *Carya* (*alba*, *ovata*) / *Cornus florida* Acidic Forest Association (CEGL002067)
FDO*	Mixed Oak - (Hardwood) Dry Forest
	Quercus alba - *Quercus rubra* - *Quercus muehlenbergii* / *Cercis canadensis* Forest Association (CEGL002070)
FDO*	Mixed Oak - (Hardwood) Dry Forest
	Quercus alba - *Quercus stellata* - *Quercus velutina* / *Schizachyrium scoparium* Woodland Association (CEGL002150)
WOD*	Mixed Oak Dry Woodland
	Quercus alba - *Quercus velutina* - *Carya alba* / *Desmodium nudiflorum* Ozark Forest Association (CEGL004270)
FDO*	Mixed Oak - (Hardwood) Dry Forest
	Quercus falcata - *Carya alba* - *Carya ovata* Forest Association (CEGL004543)
FDO*	Mixed Oak - (Hardwood) Dry Forest
	Quercus marilandica / *Vaccinium arboreum* / *Danthonia spicata* Scrub Woodland Association (CEGL002425)
WOD*	Mixed Oak Dry Woodland
	Quercus stellata - *Quercus marilandica* - *Carya* (*glabra*, *texana*) / *Vaccinium arboreum* Forest Association (CEGL002075)
FDO*	Mixed Oak - (Hardwood) Dry Forest
	Quercus stellata - *Quercus marilandica* - *Quercus velutina* - *Carya texana* / *Schizachyrium scoparium* Woodland Association (CEGL002149)
WOD*	Floodplain Hardwood Forest*
	1.B.3.Na. Eastern North American Flooded & Swamp Forest Division
	M029.Northern & Central Floodplain Forest & Scrub Macrogroup
	G040. Silver Maple - Green Ash - Sycamore Floodplain Group
	Acer negundo - (*Platanus occidentalis*, *Populus deltoides*) Forest Association (CEGL004690)
FRH*	Riparian Hardwood Forest
	Acer negundo Forest Association (CEGL005033)
FBF	Box-elder Floodplain Forest
	Acer saccharinum - *Ulmus americana* Forest Association (CEGL002586)
FRH*	Riparian Hardwood Forest

Map-class Code	Map-class Name
	Betula nigra - *Platanus occidentalis* Forest Association (CEGL002086)
FRH*	Riparian Hardwood Forest
	Fraxinus pennsylvanica - *Celtis* spp. - *Quercus* spp. - *Platanus occidentalis* Bottomland Forest Association (CEGL002410)
FRH*	Riparian Hardwood Forest
	Fraxinus pennsylvanica - *Ulmus americana* - *Celtis laevigata* / *Ilex decidua* Forest Association (CEGL002427)
FRH*	Riparian Hardwood Forest
1.B.3.Nb. Southeastern North American Flooded & Swamp Forest Division	
M031. Southern Floodplain Hardwood Forest Macrogroup	
G034. Oak - Sweetgum Floodplain Forest Group	
	Arundinaria gigantea ssp. *gigantea* Shrubland Association (CEGL003836)
SCB	Floodplain Canebrake
	Liquidambar styraciflua - (*Quercus alba*, *Acer saccharum*) / *Carpinus caroliniana* / *Lindera benzoin* Forest Association (CEGL007826)
FRH*	Riparian Hardwood Forest
	Quercus macrocarpa - *Quercus shumardii* - *Carya cordiformis* / *Chasmanthium latifolium* Forest Association (CEGL004544)
FRH*	Riparian Hardwood Forest
2. SHRUBLAND & GRASSLAND CLASS	
2.B.2.Nc. Eastern North American Grassland, Meadow & Shrubland Division	
M124. Northern & Central Alvar & Glade Macrogroup	
G178. Northern & Central Acidic Glade Group	
	Quercus stellata - (*Pinus echinata*) / *Vaccinium arboreum* / *Andropogon gerardii* - *Symphyotrichum patens* var. *patentissimum* Wooded Herbaceous Vegetation Association (CEGL007814)
HCG*	Herbaceous Calcareous Glade
	Schizachyrium scoparium - *Aristida dichotoma* - *Croton willdenowii* / Lichens Wooded Herbaceous Vegetation Association (CEGL002242)
HSG	Ozark Sandstone Glade
G179. Northern & Central Alkaline Glade Group	
	Schizachyrium scoparium - *Bouteloua curtipendula* - *Rudbeckia missouriensis* - *Mentzelia oligosperma* Wooded Herbaceous Vegetation Association (CEGL002251)
HCG*	Herbaceous Calcareous Glade
	Schizachyrium scoparium - *Sorghastrum nutans* - *Bouteloua curtipendula* - *Rudbeckia missouriensis* - *Hedyotis nigricans* Wooded Herbaceous Vegetation Association (CEGL002398)
HCG*	Herbaceous Calcareous Glade

Map-class Code	Map-class Name
2.B.2.Ne. Southeastern North American Grassland & Shrubland Division	
M307. Southeastern Ruderal Grassland & Shrubland Macrogroup	
G583. Southeastern Old Field Group	
SMX*	Ruderal Shrubland
Andropogon virginicus var. *virginicus* Herbaceous Vegetation Association (CEGL004044)	
HMX*	Ruderal Herbaceous Field
Lolium (*arundinaceum*, *pratense*) Herbaceous Vegetation Association (CEGL004048)	
HMX*	Ruderal Herbaceous Field
2.B.5.Na. North American Bog & Fen Division	
M061. Appalachian, Interior Plateau & Prairie Fen Macrogroup	
G182. Interior Plateau Seepage Fen Group	
(*Carex interior*, *Carex lurida*) - *Carex leptalea* - *Parnassia grandifolia* - *Rhynchospora capillacea* Herbaceous Vegetation Association (CEGL002404)	
N/A	N/A
2.B.6.Na. Eastern North American Freshwater Wet Meadow, Riparian & Marsh Division	
M303. Eastern North American Ruderal Wet Meadow & Marsh Macrogroup	
G557. Southeastern Ruderal Wet Meadow & Marsh Group	
HMM*	Herbaceous Marsh & Wet Meadow
M165. Eastern North American Riverscour Wetland Macrogroup	
G194. Northern & Central Riverscour Wetland Group	
Alnus serrulata Interior Shrubland Association (CEGL003894)	
SHA	Interior Alder Shrubland
Hamamelis vernalis - *Cornus obliqua* - *Hypericum prolificum* Shrubland Association (CEGL003898)	
SGB*	Riverine Gravel Bar Shrubland
Salix caroliniana Temporarily Flooded Shrubland Association (CEGL007064)	
SGB*	Riverine Gravel Bar Shrubland
Ozark Riverine Cobble - Gravel Flats Sparse Vegetation Association (CEGL007012)	
VRG	Ozark Riverine Gravel Flats
M069. Eastern North American Wet Meadow & Marsh Macrogroup	
G125. Eastern North American Freshwater Marsh Group	
Schoenoplectus tabernaemontani - *Typha* spp. - *(Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation Association (CEGL002026)	
HMM*	Herbaceous Marsh & Wet Meadow

Map-class Code	Map-class Name
	Typha latifolia Southern Herbaceous Vegetation Association (CEGL004150)
HMM*	Herbaceous Marsh & Wet Meadow
5. AQUATIC WETLAND VEGETATION CLASS	
5.B.1.Na. North American Freshwater Aquatic Vegetation Division	
M108. Eastern North American Freshwater Aquatic Vegetation Macrogroup	
G114. Eastern North American Freshwater Aquatic Vegetation Group	
	Brasenia schreberi Eastern Herbaceous Vegetation Association (CEGL004527)
HFA	Watershield Pond
	Justicia americana Herbaceous Vegetation Association (CEGL004286)
N/A	N/A
6. ROCK VEGETATION CLASS	
6.B.2.Na. Eastern North American Temperate Cliff, Scree & Rock Vegetation Division	
M111. Eastern North American Cliff & Rock Vegetation Macrogroup	
G340. Eastern North American Talus & Bluff Group	
	Limestone - Dolostone Talus Sparse Vegetation Association (CEGL002308)
N/A	N/A
	Sandstone Interior Highlands Talus Sparse Vegetation Association (CEGL002309)
N/A	N/A
8. DEVELOPED VEGETATION CULTURAL CLASS	
Herbaceous & Woody Developed Vegetation Cultural Subclass (L2)	
Other Developed Urban / Built Up Vegetation Formation (L3)	
Developed Area (NLCD 2001; 21-24)	
CDV	Developed Area
NON-NVCS UNITS	
Non-Vegetated Water & Land (<1% vegetated)	
Non-Vegetated Water	
Open Water (NLCD 2001; 11)	
NSR	Stream & River
NWP	Open Water Pond

*Map class also represents other vegetation types.

Map Classification Descriptions

We provide descriptions of map classes representing those vegetation types in the NVCS, as well as of non-vegetation features. These descriptions are provided in Appendix F: Descriptions of Map Classes. These descriptions also explain the link between map classes and the types/units they represent. Ground photos showing representation of the map classes are provided as well.

Summary Report of the Map Layer

Table 12 provides a summary report of the spatial-data layer (vegetation map) via individual map classes at the most detailed level of polygon attribution (map class, physiognomic modifiers, and special modifier). The table summarizes frequency, area, and average polygon size for each map class. Realize within the map layer that some polygons might be adjacent to each other and have the same map class but not the same physiognomic and special modifiers (thus the polygons are unique to each other by physiognomy but not by map class). A summary table of the map layer with the modifier detail simplified to the map classes would present slightly lower frequencies in number of polygons for some of the map classes as well as for the map layer in its entirety.

Some general observations and inferences we made from a quick study of the summary reports follow Table 12. Although many more inferences can be made, these are provided as an example of how one might begin to analyze the map layer and garner information from it.

Table 12. Frequencies and areas of map classes at the most detailed level of physiognomic and special modifier attribution that are represented in the vegetation map layer for the Buffalo National River (Arkansas) vegetation mapping project.

Note: the bold headings within the table (above the map classes) are primarily ad-hoc physiognomic and/or hydrologic categories to help organize the map classes; this category system is an ad-hoc arrangement and not part of any recognized classification hierarchy; however, all map classes except for those under the Open Water category represent vegetation types within the National Vegetation Classification Standard.
[Freq, Frequency; Ha, Hectare; Ave, Average; NVCS, National Vegetation Classification Standard]

Map Class	Map-class Name	Freq	Area (Ha)	Ave (Ha)
Conifer Forest				
FSP	Shortleaf Pine Forest	195	374.5	1.9
Conifer - Hardwood Forest				
FPO	Shortleaf Pine - Oak Forest	1,192	1,726.8	1.4
FCH	Ozark Red-cedar - Hardwood Forest	397	607.9	1.5
Oak - (Hardwood) Forest				
FDO	Mixed Oak - (Hardwood) Dry Forest	2,692	18,978.9	7.1
Mesic Hardwood Forest				
FBH	Ozark Rich Beech - Mixed Hardwood Forest	85	521.1	6.1
FOM	White Oak - Red Oak - Sugar Maple Mesic Forest	350	2,018.2	5.8
Successional Forest				
FPP	Pine Plantation Forest	2	3.3	1.7
FDX	Ruderal Hardwood Forest	756	1,639.0	2.2
FRS	Ruderal Eastern Red-cedar - (Pine) Forest	821	1,651.8	2.0
Bottomland Hardwood Forest				
FRH	Riparian Hardwood Forest	905	1,729.4	1.9
FBF	Box-elder Floodplain Forest	42	84.8	2.0
Conifer Woodland				
WAJ	Ozark Ashe's Juniper Woodland	847	1,276.8	1.5
WRC	Red-cedar Alkaline Bluff Woodland	126	204.8	1.6

Map Class	Map-class Name	Freq	Area (Ha)	Ave (Ha)
Conifer - Hardwood Woodland				
WPO	Ozark/Ouachita Shortleaf Pine - Oak Dry Woodland	42	53.5	1.3
Oak - (Hardwood) Woodland				
WCO	Chinquapin Oak - Ash / Little Bluestem Woodland	660	1,943.8	2.9
WOD	Mixed Oak Dry Woodland	451	776.6	1.7
Successional Shrubland				
SMX	Ruderal Shrubland	127	190.8	1.5
Bottomland Shrubland				
SCB	Floodplain Canebrake	154	63.0	0.4
SHA	Interior Alder Shrubland	2	0.4	0.2
SGB	Riverine Gravel Bar Shrubland	432	393.6	0.9
Herbaceous Glade				
HSG	Ozark Sandstone Glade	58	21.1	0.4
HCG	Herbaceous Calcareous Glade	145	56.5	0.4
Herbaceous Field				
HMX	Ruderal Herbaceous Field	432	1,939.5	4.5
Herbaceous Wetland				
HMM	Herbaceous Marsh & Wet Meadow	11	8.8	0.8
HFA	Watershield Pond	9	4.6	0.5
Gravel Bar Sparse Vegetation				
VRG	Ozark Riverine Gravel Flats	196	152.0	0.8
Cultural				
CDV	Developed Area	122	400.3	3.3
Open Water (Non-NVCS)				
NSR	Stream & River	10	1,003.1	100.3
NWP	Open Water Pond	18	3.6	0.2
	Totals	**11,279**	**37,828.4**	**3.4**

Brief Analysis and Discussion

Collectively, the BUFF spatial-database layer (vegetation map) is composed of 11,279 polygons covering 37,828.4 ha, with an average polygon size of 3.4 ha. Map classes representing natural/semi-natural types in the NVCS apply to 11,129 polygons (98.7% of all polygons, with an average polygon size of 3.3 ha) and cover 36,421.4 ha (96.3% of the entire area). Map classes representing cultural types in the NVCS apply to 122 polygons (1.1% of all polygons, with an average polygon size of 3.3 ha) and cover 400.3 ha (1.1% of the entire area). Map classes representing Non-NVCS units (open water) apply to 18 polygons (0.2% of all polygons, with an average polygon size of 55.9 ha) and cover 1,006.7 ha (2.7% of the entire area).

It is apparent from Table 12 that the Mixed Oak - (Hardwood) Dry Forest (FDO) is the dominant map class from both a polygon frequency and area standpoint. The FDO map class contributes 2,692 polygons (23.9% of all polygons, having an average polygon size of 7.1 ha) and covers 18,978.9 ha (50.2% of all area). For comparison, the nearest dominant map class in polygon frequency is the Shortleaf Pine - Oak Forest (FPO) map class, which contributes 1,192 polygons (10.6% of all polygons), a little less than half the polygon frequency of the FDO map class. Yet the FPO map class covers 1,726.8 ha (4.6 of all area), which is about one-fifth the area covered by the FDO map class. (The average polygon size of the FPO map class is 1.4 ha.) Also, for comparison, the nearest dominant map class in polygon area is the White Oak - Red Oak - Sugar Maple Mesic Forest (FOM) map class. The FOM map class covers 2,018.2 ha (5.3% of all area,

having an average polygon size of 5.8 ha), which is about one-tenth the area covered by the FDO map class. The polygon frequency of the FOM map class is 350, which is a little more than one-tenth of the polygon frequency for the FDO map class.

An interesting observation when taking into account the results from the AA (discussed in the Accuracy Assessment section) is that the FOM map class has a low users' accuracy with most of the error of confusion being with the FDO map class[6]. From the analysis of the AA, we have come to understand that most of these errors are because the mapping of FOM extended too far into some large, extensive stands consisting of dry-mesic oak forest types, which are represented by the FDO map class. Large portions of these dry-mesic oak forests are mapped with the FDO map class; however, small portions of these forests were mapped incorrectly with the FOM map class. Because of this, in reality, the FOM map class is thought to be smaller in polygon area, but not in polygon frequency, with most of the difference in area going to the FDO map class.

Considerably more analyses and deductions could be attained from the summary provided in Table 12. Other summary tables could also be derived from the map layer of localized areas (e.g., the separate management districts of the BUFF) by clipping the map layer to the desired location and running new summaries. Also, more complex summary reports could be derived, either from the map layer alone (e.g., employing physiognomic modifiers such as coverage, pattern, and height) or from introducing other spatial-data layers (e.g., soils, geology, invasive species, animal distribution, and historical land use). By performing various modifications to the vegetation map layer, one could make further deductions regarding vegetation and its ecology.

Map Layer Presentation

Figure 17 presents the map layer produced for the BUFF vegetation mapping project. The finest level of the map (the map-attribute codes consisting of map classes, physiognomic modifiers, and the special modifier) is too detailed to present; therefore, the map in Figure 17 is generalized with map classes aggregated primarily into ad-hoc physiognomic and/or hydrologic categories. These categories are the same as those provided in Table 10 and Table 12.

[6] Much of the error between the FOM and FDO map classes was due to an inadequate environmental model employed during the mapping.

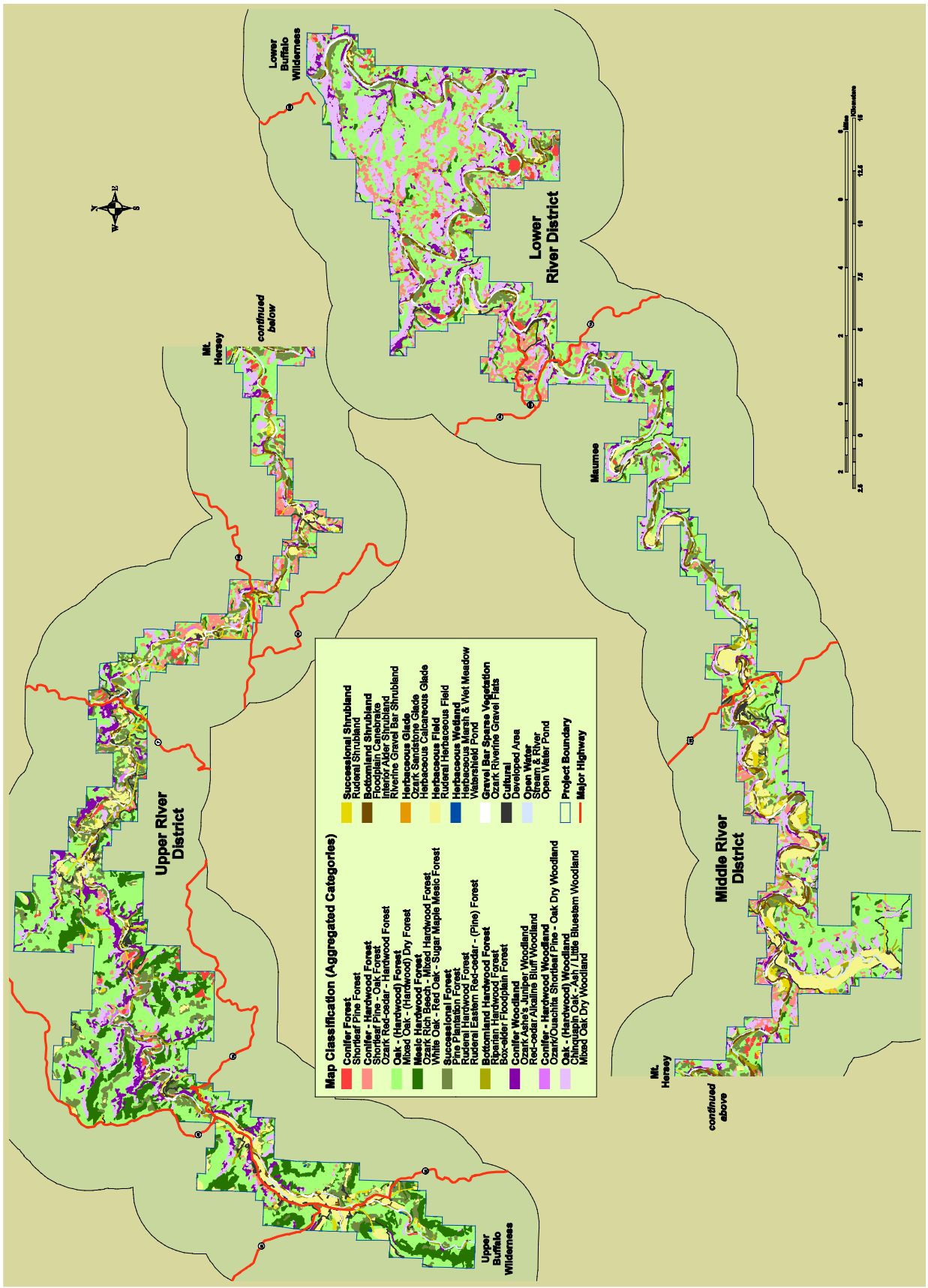


Figure 17. Vegetation of the Buffalo National River, Arkansas.

Accuracy Assessment

Methods

Purpose

The objective of an accuracy assessment (AA) is to measure the probability that a particular location has been assigned its correct map class. An AA estimates thematic errors in the data, giving users the information needed to determine data suitability for a particular application. At the same time, data producers are able to learn more about the nature of errors in the data. Thus, the two views of an AA are "users' accuracy," which is the probability that the map actually represents what was found on the ground, and "producers' accuracy," which is the probability that an AA site has been mapped correctly. An error in mapping from a users' perspective is one of commission where a map class was mapped that did not exist at the site of assessment. An error in mapping from a producers' perspective is one of omission where a map class was not mapped that existed at the site of assessment. Both producers' and users' accuracies can be obtained from the same set of data by using different analyses. Errors occur when map classes are not the same as the classes observed in the field. A major assumption of AA is that the process of mapping and the process of the assessment (e.g., the application of the classification system) are identical, so that a "false error" is not detected because of procedural differences. In actuality, the process of AA is based on field observance, and the process of mapping is based on aerial photointerpretation with different perspectives of scale and observation.

Sampling Design

We used a stratified random sampling approach to select AA sites at the Buffalo National River (BUFF). Private lands were excluded from the sampling design. We included all map classes representing natural/semi-natural vegetation types in the National Vegetation Classification Standard (NVCS) as the individual themes to randomly selected sites.

Due to the rugged topography of the BUFF, we produced a cost-surface analysis to model accessibility throughout the BUFF along a continuum from easy to extremely difficult so that dangerous and difficult sites could be blocked from the sampling scheme. The development of the cost-surface analysis began by deriving the topographic slope from a 30 m digital elevation model. Slope was considered to have a base cost equal to S1.25 (S = the slope in percent rise). Slopes >65% were considered absolute barriers. Perennial streams were also considered absolute barriers, with one exception: the central and eastern portions of the Buffalo River which were deemed passable via canoe. Canoe travel was considered 1.5x less costly than off-trail terrestrial travel. Travel by road had zero cost associated with it, whereas travel by trail was considered 10x easier than off-trail travel. The BUFF had experienced ice storms prior to AA, causing extensive tree fall, thereby making large areas of the BUFF difficult to traverse. Areas of extensive tree fall were identified by staff at the BUFF. The costs associated with traversing these areas were elevated tenfold. Corridors created by trails or roads were delineated and used to connect regions of the BUFF that would otherwise be isolated by absolute barriers.

Final cumulative costs (cost distance), which represented the shortest path with the least amount of accumulated cost, were normalized to values ranging from 0 to 100. Because of the difficult nature of accessing the higher values in this range, we focused the AA site generation on cumulative cost values <25 (Figure 18). Only in instances where map classes rarely occurred did we consider values >25.

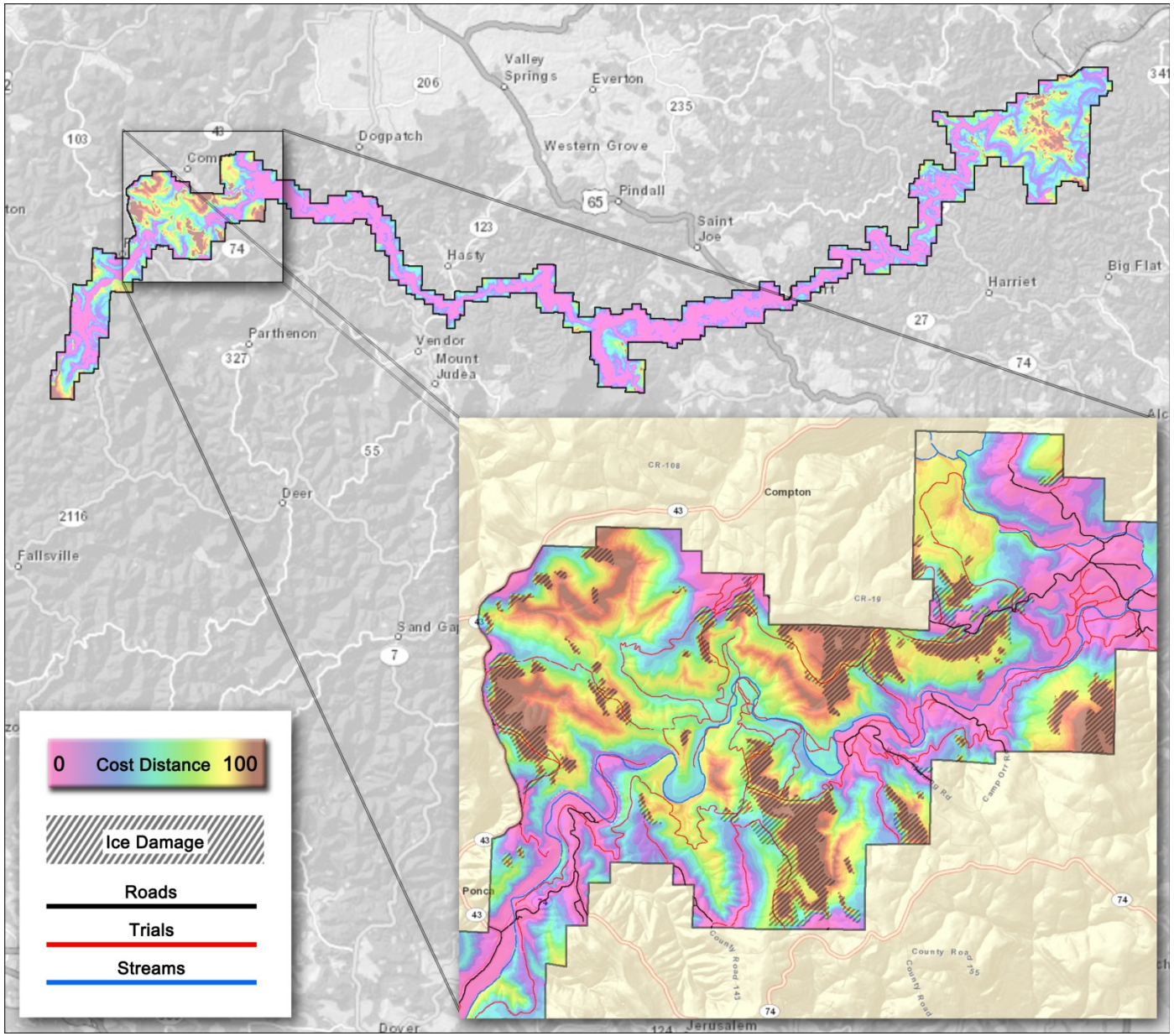


Figure 18. Cost-surface model to determine accessibility in the field for the accuracy assessment field effort at the Buffalo National River, Arkansas.

The number of samples needed for each map class (theme) was determined by using National Park Service (NPS) Vegetation Inventory Program (VIP) recommendations (Lea 2010), as suggested in the following scenarios:

- Scenario A: The class is abundant. It covers more than 50 ha in total area. The map class receives the maximum sample size of 30.
- Scenario B: The class is relatively abundant. It covers at least 8.33 ha but no more than 50 ha in total area. The map class receives a sample size of 0.6 observations per hectare of the map class (= one observation for every 1.67 ha of map class area). (This ratio allocates observations at a density rate equal to 30 observations per 50 ha).
- Scenario C: The class is relatively rare. It covers less than 8.33 ha in total area. The map class receives 5 observations (the recommended minimum sample size).

Each sampling site was buffered from the polygon boundary in order to ensure that the field classification of the observed area (a circular area approximately the size of the minimum mapping unit [MMU]) would not get confused with vegetation types represented in adjacent polygons. Confusion and error could have been attributed to several causes: (1) confusion as to whether the observation area was wholly contained within the map class, (2) positional error caused by global positioning system (GPS) error, and (3) allowable positional error included in the map data. The National Map Accuracy Standard requirement for positional accuracy of 1:24,000-scale products is 12.2 meters (FGDC 1998).

To calculate the required buffer distance, the square root of the sum squares of these error sources was calculated with the following formula:

$$\text{Buffer Distance} = \sqrt{R^2 + F^2 + M^2}$$

where R is the radius distance of the observation area, F is the expected (e.g., 90th percentile) GPS error distance, and M is the standard requirement (maximum positional error distance in the map) for positional accuracy.

The MMU that were used to map the BUFF were 0.5 ha and 0.25 ha, depending on the map class. Given these MMU, the radius length of a circular area of 0.5 ha is 40 m and of 0.25 ha is 28 m; these represent the value of R. The value of F is generalized to 15 meters, and the value of M is generalized to 12 meters. Therefore, a buffer distance of either 44 m or 34 m (depending on the MMU designated for a particular map class) was applied to the interior polygon boundaries. For some map-class themes, because they were characteristically shaped as narrow and linear, the buffer needed to be reduced as the target number of AA sites could not otherwise be attained. This was performed on a case-by-case basis. The buffer size was reduced incrementally until the target number of sites could be selected for a particular theme; this trial and error process promoted the maximum distance in buffer while still attaining the targeted number of sites.

Multiple observations in a polygon were possible, provided they did not overlap in area. In instances where the point selection process was not able to select points adequately distant from other vegetation polygons, because the vegetation type was in a very small or linear polygon, the hard-copy maps included lines that marked the interpreted boundaries between two map classes alongside the AA points.

Once the number of sites was determined and the buffer applied, random AA points were generated for each map class using Hawth's Tools for ArcGIS (Beyer 2004). These AA-site coordinates (UTM projection, Zone 15, NAD83) were provided to the field crews to upload into GPS receivers. The UMESC provided the field crews with 1:16,000-scale hard-copy maps displaying the locations of the AA sites overlaid on USGS digital raster graphics (DRG). Polygon boundaries were shown, either in part or in full, only for those that that were unable to accommodate the required buffer distance.

Field Data Collection

Field observation data was collected by botanists hired for the season and trained in AA procedures by ecologists from NatureServe and the Arkansas Natural Heritage Program (AHNP). Field crews navigated to the pre-selected AA sites using GPS and hard-copy maps. Using a key to vegetation types of the BUFF (Appendix C), the field crews selected the appropriate vegetation class. Field crews assessed a circular area approximately the size of the MMU (i.e., a circle with a 40 m radius for a MMU of 0.5 ha). It was important for the crews to do this assessment in a single vegetation community (i.e., not crossing into another vegetation type). In very narrow polygons (as indicated on the DRG maps with red boundary lines), the field crews considered the location of the point in regard to polygon boundaries, when performing the assessment area, and gave more attention to vegetation occurring along the axis of the polygon.

Within the target assessment area, crews recorded GPS coordinate location, dominant and indicator species, environmental data, and pertinent comments on the Accuracy Assessment Field Form (Appendix G). The vegetation key directed the crews to the vegetation type that best fit the site. In unclear cases, such as in instances where the key did not effectively distinguish the vegetation type, the field crew still made a single "best call" but took extra notes on complicating factors. In addition, in areas where the polygon split into two different community types, the crews were instructed to write down the vegetation type that contained the most acreage within the 40 m radius area.

Data Analyses

Field data for 891 AA sites were collected and entered into the NPS PLOTS Database Version 2 (NatureServe 2005). Originally, 908 sites were recommended, but 17 of these sites were not collected during the field season because of time constraints. Two other sites were dropped from our analysis because the field data were collected from a distance due to inaccessibility. Thus, we used 889 AA sites in the analysis (Figure 19). The database was subsequently reviewed for data entry errors. The analysis of map accuracy included the following steps:

- Initial comparative analysis of the field and map data,
- Review of all disagreements and correction of false errors as necessary,
- Individual map-class analysis,
- Final output of results into a contingency matrix, and
- Final output of the analyses and results into a spatial database for use in a geographic information system (GIS).

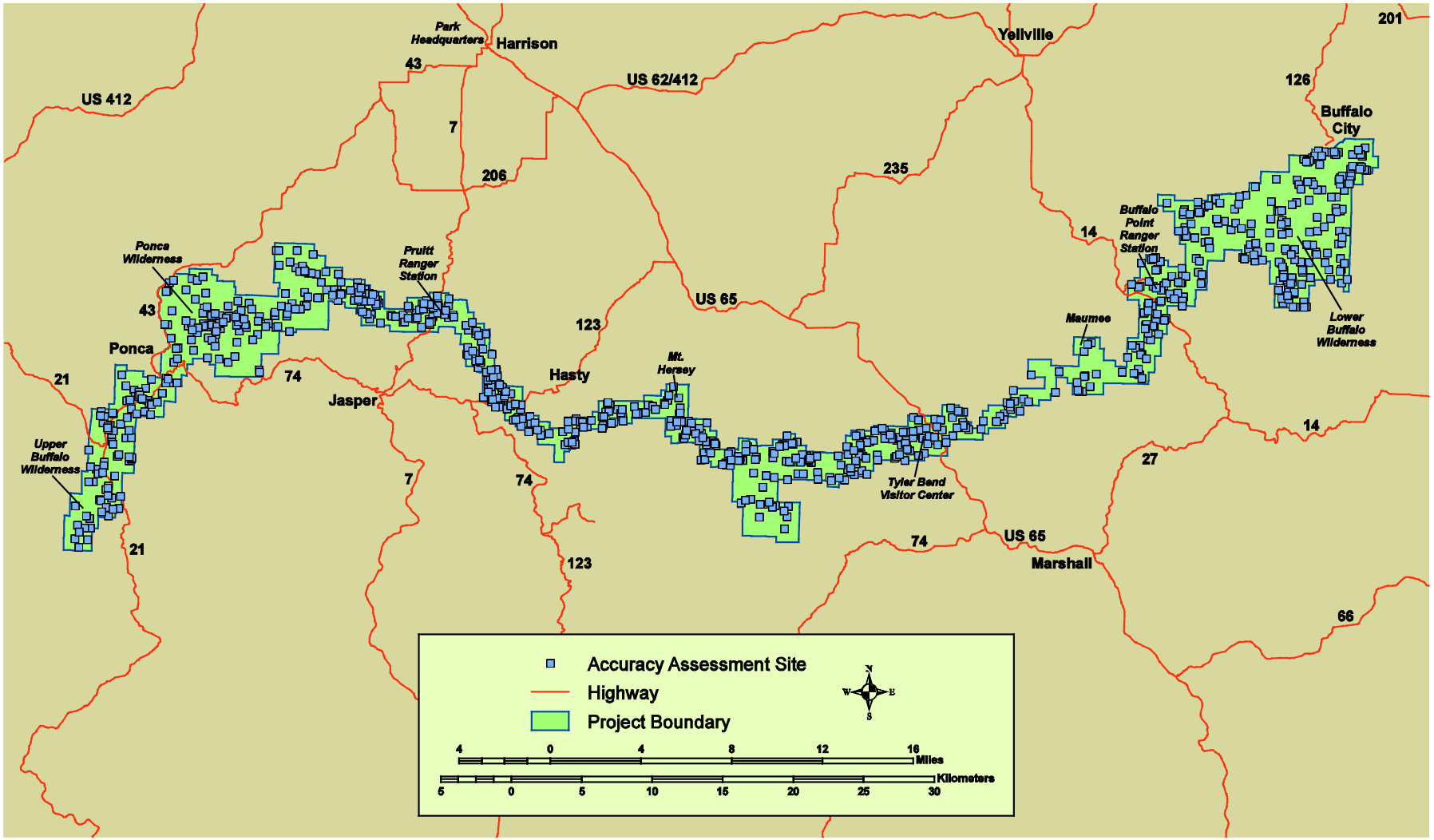


Figure 19. Locations of accuracy assessment sites used to validate the vegetation map layer for the Buffalo National River (Arkansas) vegetation mapping project.

Initial Comparative Analysis

We completed a spatial join of the AA field-site data and the map-polygon data. This allowed us to compare each AA field-site call (vegetation type) to the corresponding map-polygon call (map class representing vegetation type). We used Microsoft Excel (Microsoft Corporation) to compare and tabulate the field-site call to the map-polygon call. Our comparison accounted for alternate field calls indicated on the field data sheets by accepting map-polygon calls as correct when matching these alternate calls. The initial comparison revealed that only 42% of the AA sites matched the corresponding polygons.

Review of Disagreements

All mismatches (disagreements) were subsequently reviewed for false errors. A false error is defined as a mismatch between the AA field-site call and the map-polygon call if caused by an accuracy error in the GPS field-site coordinates, by a missing or misapplied field-site call, or by a field-site assessment of an area smaller than the MMU (an inclusion). This review process involved looking at the AA sites and their corresponding polygons by using ArcGIS (Version 10, Environmental Systems Research Institute, Redlands, California) to locate them by using a 3D monitor. We also reviewed the field data sheet to gain a fuller sense of the context of the ground data. From this process, we determined whether an initial disagreement was either a true error or a false error, which would be a match. The following paragraphs explain our process further:

Spatial Error

A spatial error might occur in one of two of the following ways: (1) the GPS device acquired inaccurate field coordinates or (2) a geospatial error existed within the vegetation map layer (called a "map-layer shift"). Either of these spatial errors could displace the newly acquired field coordinate to an adjacent polygon on the map layer. By selecting sites more than 10 m from polygon edges, we were able to minimize spatial errors in GPS coordinates, yet occasionally GPS accuracy could fall outside this parameter.

Questionable Field Call

A field assessment call might be questioned during the analysis, especially when the perspective from the ground was limited by poor vantage points, such as heavy vegetation cover or wet soils, thus preventing the field worker from walking around the MMU. If the MMU area was diverse, with more than one map class represented, it was possible to miss or not recognize other vegetation types present. We reviewed these situations by checking the aerial photographs for diversity at the site and by inspecting the field data sheets for possible problems.

Inclusion

The area assessed in the field during the AA might fall below the MMU for mapping and so be termed an inclusion. We discovered several instances through which, after reviewing the aerial photographs, we could conclude that the site in question contained vegetation that was an inclusion to the surrounding map class. Certain vegetation features were quite distinct from each other in the aerial photographs (e.g., open woodland versus dense forest), which thereby allowed easy assessment of site inclusions in the lab. An inclusion also occurred when an area in the field was a valid MMU, but the assessed area overlapped into an adjacent polygon. It was sometimes difficult to determine if the assessed area actually fell within the intended polygon, particularly in the case of smaller polygons adjacent to polygons with similar vegetation types.

Model Errors

Model errors were created when the rules of the environmental model were applied correctly by the mapper, but the AA team found vegetation types that were not forecasted by the model. The following models, of which most were used as layers to view while mapping, were created in cases where vegetation types were not discernible by signatures. Brief descriptions of each environmental model are also provided in the Vegetation Mapping section of this report.

A solar radiation model was designed to enable distinction between groups of oak forests (dry-xeric, dry-mesic, and mesic) and pine-oak forests (dry-xeric and dry-mesic), which have similar signatures on the CIR digital imagery, by separating them along a moisture continuum. Unfortunately, 62 AA sites located within polygons that were assigned oak or pine-oak forest map classes by the mappers with the use of this solar radiation model were found as incorrect upon visitation. Most of the 62 sites were found to belong to another moisture-gradient grouping of forest types. For example, whereas the model indicated high solar radiation, which prompted the mappers to assign the area to the dry-xeric oak forest map class, the field crews for AA classified the site as one of the dry-mesic oak forests types. Or, for example, whereas the model indicated low solar radiation, which prompted the mappers to assign the area to the mesic oak forest map class, the field crews classified the site as one of the dry-mesic oak forests types.

A soil pH model was used to separate the grouping of dry-mesic oak forests, which was determined from the solar radiation model, into two more finely detailed groupings: acidic and calcareous (alkaline). (These groupings of dry-mesic forests, too, have similar signatures on the CIR digital imagery.) A total of 17 AA sites located within areas that were assigned dry-mesic oak forest map classes by the mappers with the use of this soil pH model were found as incorrect upon visitation; many were found in error to the complementing pH grouping of oak forest types. For example, whereas the model indicated acidic soils, which prompted the mappers to assign the area with the acidic dry-mesic oak forest map class, the field crews for AA classified the site as one of the calcareous dry-mesic oak forest types. Interestingly, the soil pH model was also used to separate acidic and calcareous herbaceous glades, and it did so successfully. Yet the soil pH model was also used as part of a more complex model structure in order to separate the cedar/juniper types, as discussed below. The entire model structure, of which the soil pH model was a part, did so with partial success.

A complex model involving location, geology formation, soil pH, steepness of slope, and physiognomies was used to separate cedar/juniper forest/woodland types that have similar signatures on the CIR digital imagery. Figure 16 in the Vegetation Mapping section of this report shows the intricate decision process performed by the mappers in assigning the cedar/juniper map classes. A total of 19 AA sites located within areas that were assigned cedar/juniper map classes by the mappers with the use of this model were found as incorrect upon visitation. Many of the 19 sites were found to have been confused during the mapping with one of the other cedar/juniper forest/woodland types.

A riverine mapping-convention model was used to separate several riparian forest types: first into large or small river systems and then into dynamic or stable systems. From this model, several riparian forest types were sorted into four map classes. Sixty AA sites located within areas that were assigned with one of these four map classes by the mappers with the aid of this model, however, were found to be incorrect upon visitation. Many of the 60 sites were found to

have been confused with another one of the four riparian forest map classes. It was originally thought that specific riparian forest types existed primarily within one of the four riparian locations. But from the results of the AA, it became clear that these riparian forest types were not restricted to one particular environmental setting.

Concern over the model errors prompted us to convene a two-day meeting[7]. The meeting was held at the UMESC, March 28–29, 2011, to discuss the errors and to explore various avenues for resolution. The strategy for the meeting was to identify patterns that might allow model adjustments for better accuracy. But attempts to tweak the models to better reflect what was actually found on the ground did not improve the accuracies.

Individual Map-class Analysis

In regards to individual map-class accuracies that fell below standards of the NPS VIP, we compared map classes to determine which were in confusion. If repeated confusion was evident, we then determined whether to merge the map classes to gain higher accuracy or to leave the map classes as they were, regardless if to do so would lower accuracy. Because many of the environmental models had not been successful in guiding the mappers, we decided to merge many of the map classes that had originally been based on the model indicators. Yet other map classes were left with lower accuracies because the benefit was determined greater separate with lower accuracies than merged with higher accuracies. These decisions were made with input from staff at the BUFF.

Final Output

The results of the final analyses were transferred into a contingency table (matrix), where we calculated percentages of users' and producers' accuracies for each map class. The matrix shows both the frequency of agreement and the placement of disagreements.

AA Spatial Database

For use in a GIS, we produced a feature-class layer of the AA site locations, as well as supporting tables, and incorporated the layer and tables into the geodatabase for the BUFF vegetation mapping project. The field data for AA are also included in the PLOTS Database.

Results

Of the 889 sites used in the analysis, the initial comparison revealed only 42% of the AA sites matched the corresponding polygons that represented natural/semi-natural vegetation types in the NVCS. Through the review process of correcting false errors and, subsequently, of combining some map classes because of low accuracies, we eventually increased the overall accuracy to 78.9%. A kappa adjustment for chance agreements resulted in an overall accuracy of 77.3%. The contingency matrix for the AA results is provided in Appendix H: Accuracy Assessment Contingency Table. The matrix shows the accuracy of each map class (along with 90% confidence intervals), as well as the users' accuracy reflecting errors of inclusion (commission errors) and producers' accuracy reflecting errors of exclusion (omission errors). The width of each confidence interval has been affected by the sample size used to derive the point estimate.

[7] Participants in the two-day meeting included the independent contractor for the AA analysis, ecologists from NatureServe, and staff from the UMESC to provide support with the environmental models and map classification history.

Our overall AA fell just short of the accuracy requirement of 80% established by the NPS VIP; however, our overall accuracy of 78.9% was nevertheless determined by the NPS as indicative of a product that would be useful to users of the vegetation database layer. The most important factors affecting accuracy were disagreements between mappers and field crews in the level of disturbance; difficulties distinguishing eastern red-cedar from pines during the mapping; disagreements between mappers and field crews in percent covers estimates of the strata; overestimating the extent of mesic tree species during the mapping, particularly beech; and failure of the models to differentiate similar vegetation communities from one another. Past experience indicates that field estimates of cover are generally lower than aerial estimates, so some errors were simply a result of two different perspectives.

Some individual map class accuracies did not meet the 80% requirement (taking into account 90% confidence intervals). In general, errors of omission (producers' accuracy) occurred in fewer map classes than did errors of commission (users' accuracy). The following are map classes for which the mapping project did not meet the required rates of accuracy, in terms of either the actual percentage or the confidence intervals.

Users' Accuracy (Errors of Commission)

The users' accuracy for the Mesic Oak - Hardwood Forest (FOM) map class was 19%, with a 90% confidence interval of 4–33%. Of the 27 polygons mapped as FOM, 22 AA sites within those polygons were found to contain different vegetation types, with errors attributed as follows:

- One Ozark Rich Beech - Mixed Hardwood Forest (FBH) site was mapped as FOM because of misinterpreting the percent of beech present;
- Twenty-one Mixed Oak - (Hardwood) Dry Forest (FDO) sites were mapped as FOM because of overextending polygon boundaries too broadly into areas with too high of percentages of oak.

The users' accuracy for the Ruderal Eastern Red-cedar - (Pine) Forest (FRS) map class was 43%, with a 90% confidence interval of 32–55%. Of the 60 polygons mapped as FRS, 34 AA sites within those polygons were found to contain different vegetation types, with errors attributed as follows:

- Three Ozark Red-cedar - Hardwood Forest/Woodland (FCH) sites were mapped as FRS because of either disagreements on the level of anthropogenic disturbance or overestimating the percentage of shortleaf pine to eastern red-cedar;
- Four Interior Mid- to Late-Successional Sweetgum - Oak Forest (FDX) sites were mapped as FRS because of disagreements on the level of anthropogenic disturbance;
- Five Mixed Oak - (Hardwood) Dry Forest (FDO) sites were mapped as FRS because of overestimating the relative density of red-cedar in the canopy (it was present in the subcanopies),
- Thirteen Shortleaf Pine-Oak Forest (FPO) sites were mapped as FRS because of either overestimating the relative density of red-cedar or a misidentifying pine as red-cedar;
- Three Shortleaf Pine Forest (FSP) sites were mapped as FRS because of either overestimating the relative density of red-cedar or a misidentifying pine as red-cedar;

- One Riparian Hardwood Forest (FRH) site was mapped as FRS because of underestimating the relative density of sweetgum or overestimating the relative density of red-cedar; this point was near the edge of two polygons;
- Three Chinquapin Oak - Ash / Little Bluestem Woodland (WCO) sites were mapped as FRS because of either incorrectly drawing polygon lines or overestimating the relative density of conifers;
- Two Mixed Ruderal Shrubland (SMX) sites were mapped as FRS because of misinterpreting tall shrubs as short forest;

The users' accuracy for the Ozark Ashe's Juniper Woodland (WAJ) map class was 50%, with a 90% confidence interval of 33–67%. Of the 28 polygons mapped as WAJ, 14 AA sites within those polygons were found to contain different vegetation types, with errors attributed as follows:

- Eight Ozark Red-cedar - Hardwood Forest/Woodland (FCH) sites were mapped as WAJ because of flaws in the environmental model;
- Three Mixed Oak - (Hardwood) Dry Forest (FDO) sites were mapped as WAJ because of overestimating the relative density of eastern red-cedar;
- Two Chinquapin Oak - Ash / Little Bluestem Woodland (WCO) sites were mapped as WAJ because of overestimating of the relative density of red-cedar in the canopy;
- One Red-cedar Alkaline Bluff Woodland (WRC) site was mapped as WAJ because of flaws in the environmental model;

The users' accuracy for the Chinquapin Oak - Ash / Little Bluestem Woodland (WCO) map class was 63%, with a 90% confidence interval of 47–79%. Of the 30 polygons mapped as WCO, 11 AA sites within those polygons were found to contain different vegetation types, with errors attributed as follows:

- Six Mixed Oak - (Hardwood) Dry Forest (FDO) sites were mapped as WCO because of misinterpreting the canopy as woodland instead of forest;
- Four Mixed Oak Dry Woodland (WOD) sites were mapped as WCO because of flaws in the pH model;
- One Herbaceous Calcareous Glade (HCG) site was mapped as WCO because of not delineating an herbaceous polygon;

The users' accuracy for the Red-cedar Alkaline Bluff Woodland (WRC) map class was 52%, with a 90% confidence interval of 34–70%. Of the 27 polygons mapped as WRC, 13 AA sites within those polygons were found to contain different vegetation types, with errors attributed as follows:

- Eight Ozark Red-cedar - Hardwood Forest/Woodland (FCH) sites were mapped as WRC because of incorrectly applying the model or the model was incompatible;
- One Shortleaf Pine - Oak Forest (FPO) site was mapped as WRC because of misidentifying of shortleaf pine as eastern red-cedar;
- Two Dolomite - Limestone Glade (HCG) sites were mapped as WRC because of not delineating small herbaceous polygons;

- Two Ozark Sandstone Glade (HSG)) sites were mapped as WRC because of not delineating small herbaceous polygons;

Producers' Accuracy (Errors of Omission)

The producers' accuracy for the Ozark Red-cedar - Hardwood Forest/Woodland (FCH) map class was 45%, with a 90% confidence interval of 32–58%. Of the 49 AA sites classified in the field as FCH, 27 sites fell within polygons that were mapped as other vegetation types, with errors attributed as follows:

- Two polygons were mapped as Shortleaf Pine - Oak Forest (FPO) because of misidentifying eastern red-cedar as shortleaf pine;
- Five polygons were mapped as Shortleaf Pine Forest (FSP) because of misidentifying red-cedar as pine;
- Three polygons were mapped as Shortleaf Pine Forest (FRS) because of disagreements on the amount of disturbance;
- Eight polygons were mapped as Ozark Ashe's Juniper Woodland (WAJ) because of the inability of the model to accurately predict communities;
- One polygon was mapped as Ozark/Ouachita Shortleaf Pine - Oak Dry Woodland (WPO) because of a misidentifying red-cedar as pine and underestimating the canopy closure;
- Eight polygons were mapped as Red-cedar Alkaline Bluff Woodland (WRC) because of the inability of the model to accurately predict communities.

The producers' accuracy for the Mixed Oak - (Hardwood) Dry Forest (FDO) map class was 66%, with a 90% confidence interval of 60–72%. Of the 173 AA sites classified as FDO, 59 sites fell within polygons that were mapped as other vegetation types, with errors attributed as follows:

- Five polygons were mapped as Ozark Rich Beech - Mixed Hardwood Forest (FBH) because of disagreements on the percentage of beech present;
- Seven polygons were mapped as Ozark Red-cedar - Hardwood Forest (FCH) because of disagreements on the percentage of eastern red-cedar in the canopy;
- One polygon was mapped as Ruderal Hardwood Forest (FDX) because of disagreement on the extent of disturbance:
- Twenty-one polygons were mapped as White Oak - Red Oak - Sugar Maple Mesic Forest (FOM) because of the failure of the solar radiation model to aid in differentiating between the two types;
- Seven polygons were mapped as Shortleaf Pine - Oak Forest (FPO) because of disagreements on the percentage of pine:
- Five polygons were mapped as Ruderal Eastern Red-cedar - (Pine) Forest (FRS) because of disagreements on the percentage of red-cedar;
- Three polygons were mapped as Riparian Hardwood Forest (FRH) because of misinterpreting the environmental setting;
- Three polygons were mapped as Ozark Ashe's Juniper Woodland (WAJ) because of disagreements on the percentages of canopy cover and red-cedar;
- Six polygons were mapped as Chinquapin Oak - Ash / Little Bluestem Woodland (WCO) because of disagreements on the percentage of canopy cover;

- One polygon was mapped as Mixed Oak Dry Woodland (WOD) because of disagreement on the percentage of canopy cover.

The producers' accuracy for the Mixed Oak Dry Woodland (WOD) map class was 33%, with a 90% confidence interval of 2–65%. Of the nine AA sites classified in the field as WOD, six sites fell within polygons that were mapped as other vegetation types, with errors attributed as follows:

- Four polygons were mapped as Chinquapin Oak - Ash / Little Bluestem Woodland (WCO) because of the inability of the pH model to accurately predict communities;
- Two polygons were mapped as Ozark/Ouachita Shortleaf Pine - Oak Dry Woodland (WPO) because of overestimating of the percentage of pines.

Discussion

One of the biggest disappointments we experienced during this BUFF vegetation mapping project was the failure of environmental models we built to accurately predict the relationship between vegetation types and physical environmental factors. The models were developed to help the mappers locate and identify various vegetation types—that were not discernible by viewing the CIR digital imagery alone—by their assumed relationships to solar radiation, soil pH, geologic formation, steepness of slope, or riverine stability. The models were built according to our best understanding of the relationships between the vegetation types and the environmental factors involved. Actual testing of the relationships in the field, however, was limited due to time constraints. More time for testing the relationships between the models and the vegetation types in the field might have allowed for more of an empirical approach and for more adjustments to have been made where needed. Another likely contributing factor to the failure of the models was the usage of data that were too course in resolution; we found this was the case with the soil pH model. The soil pH data from soil maps of the BUFF area at the time we performed mapping may have been too general for the level of classification detail for which we strived. Then there were the inherent errors in accuracy of the individual environmental data sets; errors within the data sets likely carried on into the mapping.

The inability of the models to assist in accurately delineating similar-looking vegetation types resulted in both low users' and producers' accuracies. After discussion with staff at the BUFF, we agreed to combine several of the map classes to provide a more accurate map with less detailed classification. Other map classes were kept separate while accepting lower accuracies after the cost-benefit ratio was discussed.

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Appendix A: Plot Sampling Form

Park: Buffalo National River **Plot Code:** BUFF **State: AR Location org: NPS**

Provisional community name (*and NVC ElCode if known*)_____

_____

Survey date:_____ **time** ___:___ **Surveyors initials:**_____

Directions to plot (including any notes on best access route, and mile marker):

Time taken to walk to plot:

PLOT CONFIGURATION (Depict the plot layout on right with respect to the surrounding area and attempt to draw in points where GPS positions were collected, witness tree, bearing of centerline, locations of pictures taken, and communities near the plot.)

Plot representativeness -Is the surrounding area all the same? ____YES ____ NO - If not, depict below)

PLOT LOCATION (Below show general plot location)

Plot dimensions: _____ m X _____ m

Centerline bearing: _____°

Est. extent of occurrence of community:

<1HA 1-10 HA 10-100HA >100HA

Est. linear extent of community (m):

North= East=

South= West=

PIC #_____

Description of pictures (default order = N,E,S & W from GPS point at middle of plot) :_____

_____

–

Select one: UTM / Lat/long _____ N _____ W **Elevation** _____ **m / ft**

GPS Techniques/Equipment: _____Garmin V_____ __ **Datum(pick one)** WGS84 / NAD83 / NAD27

GPS file name ___ ___ ___ ___ (plot # + A, or B if more than 1 plot per waypoint, ex. 213A)

Averaging performed (at least 120 observations)? _____ Coordinate accuracy _____ m / ft 3d WAAS?____ 3d?_____ 2d?_____

Park: Buffalo National River **Plot Code:** BUFF **State:** AR **Location org:** NPS

ENVIRONMENTAL / SITE INFORMATION

Measured Slope _____ ° _____ %

__ Flat 0 ° 0 %
__ Gentle 0-5 ° 1-9%
__ Moderate 6-14 ° 10-25%
__ Somewhat steep 15-25 ° 26-49%
__ Steep 27-45 ° 50-100%
__ Very steep 45-69 ° 101-275%
__ Abrupt 70-100 ° 276-300
__ ovrhng/shltrd >100 ° >300%

Measured Aspect _____ ° (N=0 °)

__ Flat __ SE 113-157 °
__ Variable __ S 158-202 °
__ N 338-22 ° __ SW 203-247 °
__ NE 23-67 ° __ W 248-292 °
__ E 68-112 ° __ NW 293-337 °

Topographic Position
__ Interfluve (Ridge/summit/crest)
__ High Slope (upper/convex slope)
__ Midslope
__ Lowslope (lower/footslope)
__ Toe Slope
__ Low Level (Terrace)
__ Channel Bed

Cowardin System
__ Upland __ Palustrine __ Lacustrine __ Riverine

Landform (check most applicable)

__ Alluvial flat
__ Alluvial terrace
__ Bank
__ Bar
__ Bench
__ Blowout
__ Bottomlands
__ Channel
__ Cliff
__ Colluvial shoulder
__ Colluvial slope
__ Cove
__ Debris slide
__ Depositional levee
__ Depositional stream terrace
__ Depression
__ Drainage
__ Draw
__ Eroding stream channel
__ Erosional stream terrace
__ Escarpment
__ Floodplain
__ Gap
__ Gorge
__ Headland
__ Hills
__ Hillslope bedrock outcrop
__ Interfluve
__ Knob
__ Lake
__ Ledge
__ Levee
__ Lowland
__ Noseslope
__ Oxbow
__ Plateau
__ Ravine
__ Ridge
__ Ridge and valley
__ Ridgetop bedrock outcrop
__ Riverbed
__ Saddle
__ Seep
__ Slide
__ Slope
__ Slough
__ Stream terrace
__ Swale
__ Talus
__ Toe slope
__ Valley
__ Other _____

Rock types present:

Hydrologic Regime ***(check only for wetlands)***
__ Not a wetland (Upland: XERIC : DRY - MESIC : MESIC)
__ Permanently flooded __ Semipermanently flooded __ Temporarily Flooded (e.g. floodplains) ___ Other_____
__ Seasonally Flooded (e.g. seasonal ponds) __ Saturated (e.g. bogs, perennial seeps) __ Unknown

QUALITATIVE ASSESSMENT:

A) HYDROLOGY:

B) LANDSCAPE AND LANDUSE HISTORY (including disturbance history and possible threats to sustainability):

Soil Texture:
__ Sand __ Peat __ Silt loam __Muck
__ Sandy loam __ Loam __ Clay loam __Clay

Drainage:
__ Rapidly drained __ Moderately well drained __Somewhat poorly drained
__ Well drained __ Poorly drained __ Very poorly drained

Ground cover [Exclusive of living plants; adds to 100%]

_____% Bedrock
_____% Large rocks (cobbles, boulders >10cm)
_____% Small rocks (gravel, 0.2-10 cm)
_____% Loose sand (0.1-2 m**m)**
_____% Litter, duff
_____% Wood (> 1 cm)
_____% Water
_____% Bare soil
_____% Other _____

Leaf type (dominant stratum):
__ Broad-leaved
__ Needle-leaved
__ Graminoid
__ Broad-leaved herbaceous
__ Mixed

Leaf phenology (dominant stratum):
__ Evergreen
__ Cold-deciduous
__ Mixed evergreen-cold-deciduous
__ Herb - Annual
__ Herb - Perennial

Physiognomic Class
__ Forest (closed tree canopy)
__ Woodland (open tree canopy)
__ Shrubland
__ Herbaceous (less than 25% woody layers)
__ Nonvascular
__ Sparse Vegetation

Natural and Anthropogenic Disturbance
_ logging _ fire _ Hydrologic
_ erosion _ trails/roads _ Agriculture
_ grazing/browsing _ wind/ice damage _ Old Growth
_ pine bark beetle _ exotic plants _ Fire Suppression
_ dogwood anthr _ ORV

Disturbance and animal use comments:

Park: Buffalo National River **Plot Code:** BUFF **State:** AR **Location org:** NPS

QUANTITATIVE VEGETATION SAMPLE **"DEFAULT" TAXONOMIC REFERENCE:** Checklist of Arkansas Flora

STRATA	STRATA HEIGHT (1 only)	COVER CLASS	DOMINANT/ DIAGNOSTIC SPECIES	Height scale (use tallest one for strata)	% cover for strata = top of cover class
Emergent – T1				< .5m **1**	**0-5% 1**
Tree Canopy T2				.5-1m **2**	**5-10% 2**
Subcanopy T3				1-2m **3**	**10-20% 3**
Tall shrub S1				2-5m **4**	**20-30% 4**
Short shrub S2				5-10m **5**	**30-40% 5**
Herbaceous				10-15m **6**	**40-50% 6**
Non-vascular				15-20m **7**	**50-60% 7**
Vine/liana				20-35m **8**	**60-70% 8**
Other notable species (indicators of distinctive conditions, e.g. high pH soil, elevation, geographic region, other particularly abundant species):				35-50m **9**	**70-80% 9**
				>50m **10**	**80-90% 10**
					90-100% 11

T1: *Emergent * ***T2:*** *Tree Canopy * ***T3*** *Subcanopy * ***S1*** *Tall Shrub (>1m; to 5m) * ***S2*** *Short Shrub (< 1m) * ***H*** *Herbaceous * ***N*** *Nonvascular * ***V*** *Vines (lianas) * ***E*** *Epiphytes*

SPECIES COMPOSITION AND COVER/ABUNDANCE CLASS BY STRATUM (enter cover values for each stratum AND for Total cover)

T 1	T 2	T 3	S 1	S 2	H	N	V	E	Total Cover	Name (7 letter code or full name)	Collected? Spec #?	Discarded ?	Other tax. ref?	Cover cls
														1 trace
														2 0.1-1%
														3 1-2%
														4 2-5%
														5 5-10%
														6 10-25%
														7 25-50%
														8 50-75%
														9 75-95%
														10 >95%

Park: Buffalo National River **Plot Code: BUFF** **State: AR** **Location org: NPS**

SPECIES COMPOSITION AND COVER/ABUNDANCE CLASS BY STRATUM

T 1	T 2	T 3	S 1	S 2	H	N	V	E	Total cover	Name (7 letter acronym or full name)	Collected? Spec #?	Discarded ?	Other tax. ref?	Cover classes
														1. trace
														2. 0.1-1%
														3. 1-2%
														4. 2-5%
														5. 5-10%
														6. 10-25%
														7. 25-50%
														8. 50-75%
														9. 75-95%
														10. >95%
														T1: Emergent (Very Rare)
														T2: Tree Can
														T3 Subcanopy
														S1 Tall Shrub (>1m; to 5m)
														S2 Short Shrub (< 1m)
														H Herbaceous
														N Nonvascular
														V Vines (lianas)
														E Epiphytes

Use bottom of this sheet or additional pages for other species in plot

Appendix B: Descriptions of Vegetation Types

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U.S. NATIONAL VEGETATION CLASSIFICATION

Associations of
Buffalo National River

14 December 2011

by

NatureServe

1101 Wilson Blvd., 15th floor
Arlington, VA 22209

6114 Fayetteville St, Suite 109
Durham, NC 27713

This subset of the International Ecological Classification Standard covers associations and alliances attributed to Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, Durham, NC <mary_russo@natureserve.org> and Milo Pyne, Senior Regional Ecologist, Durham, NC <milo_pyne@natureserve.org>.



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- **United States**
- Central NatureServe Office, Arlington, VA; Eastern Regional Office, Boston, MA; Midwestern Regional Office, Minneapolis, MN; Southeastern Regional Office, Durham, NC; Western Regional Office, Boulder, CO; Alabama Natural Heritage Program, Montgomery AL; Alaska Natural Heritage Program, Anchorage, AK; Arizona Heritage Data Management Center, Phoenix AZ; Arkansas Natural Heritage Commission Little Rock, AR; Blue Ridge Parkway, Asheville, NC; California Natural Heritage Program, Sacramento, CA; Colorado Natural Heritage Program, Fort Collins, CO; Connecticut Natural Diversity Database, Hartford, CT; Delaware Natural Heritage Program, Smyrna, DE; District of Columbia Natural Heritage Program/National Capital Region Conservation Data Center, Washington DC; Florida Natural Areas Inventory, Tallahassee, FL; Georgia Natural Heritage Program, Social Circle, GA; Great Smoky Mountains National Park, Gatlinburg, TN; Gulf Islands National Seashore, Gulf Breeze, FL; Hawaii Natural Heritage Program, Honolulu, Hawaii; Idaho Conservation Data Center, Boise, ID; Illinois Natural Heritage Division/Illinois Natural Heritage Database Program, Springfield, IL; Indiana Natural Heritage Data Center, Indianapolis, IN; Iowa Natural Areas Inventory, Des Moines, IA; Kansas Natural Heritage Inventory, Lawrence, KS; Kentucky Natural Heritage Program, Frankfort, KY; Louisiana Natural Heritage Program, Baton Rouge, LA; Maine Natural Areas Program, Augusta, ME; Mammoth Cave National Park, Mammoth Cave, KY; Maryland Wildlife & Heritage Division, Annapolis, MD; Massachusetts Natural Heritage & Endangered Species Program, Westborough, MA; Michigan Natural Features Inventory, Lansing, MI; Minnesota Natural Heritage & Nongame Research and Minnesota County Biological Survey, St. Paul, MN; Mississippi Natural Heritage Program, Jackson, MI; Missouri Natural Heritage Database, Jefferson City, MO; Montana Natural Heritage Program, Helena, MT; National Forest in North Carolina, Asheville, NC; National Forests in Florida, Tallahassee, FL; National Park Service, Southeastern Regional Office, Atlanta, GA; Navajo Natural Heritage Program, Window Rock, AZ; Nebraska Natural Heritage Program, Lincoln, NE; Nevada Natural Heritage Program, Carson City, NV; New Hampshire Natural Heritage Inventory, Concord, NH; New Jersey Natural Heritage Program, Trenton, NJ; New Mexico Natural Heritage Program, Albuquerque , NM; New York Natural Heritage Program, Latham, NY; North Carolina Natural Heritage Program, Raleigh, NC; North Dakota Natural Heritage Inventory, Bismarck, ND; Ohio Natural Heritage Database, Columbus, OH; Oklahoma Natural Heritage Inventory, Norman, OK; Oregon Natural Heritage Program, Portland, OR; Pennsylvania Natural Diversity Inventory, PA; Rhode Island Natural Heritage Program, Providence, RI; South Carolina Heritage Trust, Columbia, SC; South Dakota Natural Heritage Data Base, Pierre, SD; Tennessee Division of Natural Heritage, Nashville, TN; Tennessee Valley Authority Heritage Program, Norris, TN; Texas Conservation Data Center, San Antonio, TX; Utah Natural Heritage Program, Salt Lake City, UT; Vermont Nongame & Natural Heritage Program, Waterbury, VT; Virginia Division of Natural Heritage, Richmond, VA; Washington Natural Heritage Program, Olympia, WA; West Virginia Natural Heritage Program, Elkins, WV; Wisconsin Natural Heritage Program, Madison, WI; Wyoming Natural Diversity Database, Laramie, WY
- **Canada**
- Alberta Natural Heritage Information Centre, Edmonton, AB, Canada; Atlantic Canada Conservation Data Centre, Sackville, New Brunswick, Canada; British Columbia Conservation Data Centre, Victoria, BC, Canada; Manitoba Conservation Data Centre. Winnipeg, MB, Canada; Ontario Natural Heritage Information Centre, Peterborough, ON, Canada; Quebec Conservation Data Centre, Quebec, QC, Canada; Saskatchewan Conservation Data Centre, Regina, SK, Canada; Yukon Conservation Data Centre, Yukon, Canada
- **Latin American and Caribbean**
- Centro de Datos para la Conservacion de Bolivia, La Paz , Bolivia; Centro de Datos para la Conservacion de Colombia, Cali,Valle, Columbia; Centro de Datos para la Conservacion de Ecuador, Quito, Ecuador; Centro de Datos para la Conservacion de Guatemala, Ciudad de Guatemala , Guatemala; Centro de Datos para la Conservacion de Panama, Querry Heights , Panama; Centro de Datos para la Conservacion de Paraguay, San Lorenzo , Paraguay; Centro de Datos para la Conservacion de Peru, Lima, Peru; Centro de Datos para la Conservacion de Sonora, Hermosillo, Sonora , Mexico; Netherlands Antilles Natural Heritage Program, Curacao , Netherlands Antilles; Puerto Rico-Departmento De Recursos Naturales Y Ambientales, Puerto Rico; Virgin Islands Conservation Data Center, St. Thomas, Virgin Islands.
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1. FOREST TO OPEN WOODLAND

1.B.1. Warm Temperate Forest

1.B.1.Na. Southeastern North American Warm Temperate Forest

M305. Southeastern North American Ruderal Forest & Plantation

G029. Southeast Conifer & Hardwood Plantation

Shortleaf Pine Plantation
***Pinus echinata* Planted Forest**
Shortleaf Pine Planted Forest
Identifier: CEGL007169

NVC CLASSIFICATION

Division	Southeastern North American Warm Temperate Forest (1.B.1.Na)
Macrogroup	Southeastern North American Ruderal Forest & Plantation (M305)
Group	Southeast Conifer & Hardwood Plantation (G029)
Association (Common name)	Shortleaf Pine Plantation

ELEMENT CONCEPT

Global Summary: This association includes young, monospecific, dense stands of *Pinus echinata* (shortleaf pine) across a variety of managed site conditions. The majority of stands accommodated in this association were artificially established through mechanical planting, although they may be established through other means such as seed-tree cuts. In most cases these stands support almost no other tree species, and typically very little understory. These are cultivated forests and are not considered natural or near-natural vegetation. If these areas exist on private lands, they are often maintained for the harvest of forest products and rarely exceeds 20-40 years of age.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.
Global Vegetation: Stands of this alliance are young, monospecific plantations dominated by *Pinus echinata* (shortleaf pine).

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (cultural) (8-Aug-2000). This community represents vegetation which has been planted in its current location by humans and/or is treated with annual tillage, a modified conservation tillage, or other intensive management or manipulation. It is not a conservation priority and does not receive a conservation rank.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: During the year 2000, a vast majority of stands in the Daniel Boone National Forest (Kentucky) suffered from damage by the southern pine beetle (*Dendroctonus frontalis*). They will apparently be replanted.
Global Related Concepts:
Shortleaf Pine: 75 (Eyre 1980) >

ELEMENT DISTRIBUTION

Buffalo National River Range: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.
Global Range: This alliance is found throughout the southeastern United States.
Nations: US
States/Provinces: AL, AR, GA, KY, LA, MS, NC, OK, SC, TN?, TX
TNC Ecoregions: 38:C, 39:C, 40:C, 41:P, 43:P, 44:P, 50:C, 51:C, 52:P, 53:C
USFS Ecoregions (1994/95): 221Ha:CC?, 221Hc:CCC, 221He:CCC, 222Eb:CCC, 222En:CCC, 222Eo:CCC, 231Dc:CCC, 231E:CC, 232Bm:CCC, M221D:CC, M222A:CC, M231A:CC

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Federal Lands: NPS (Buffalo River?); USFS (Chattahoochee, Chattahoochee (Piedmont)?, Chattahoochee (Southern Blue Ridge), Cherokee?, Daniel Boone, Davy Crockett, Kisatchie, Ouachita, Ouachita (Coastal Plain), Ouachita (Mountains), Ozark, Sabine, Sam Houston, Talladega (Oakmulgee)?, Talladega (Talladega)?, Talladega?, Tuskegee?)

ELEMENT SOURCES

Buffalo National River Plots: None.
Local Description Authors: M. Pyne
Global Description Authors: A.S. Weakley
References: Eyre 1980, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data

Loblolly Pine Plantation

***Pinus taeda* Planted Forest**
Loblolly Pine Planted Forest
Identifier: CEGL007179

NVC CLASSIFICATION

Division	Southeastern North American Warm Temperate Forest (1.B.1.Na)
Macrogroup	Southeastern North American Ruderal Forest & Plantation (M305)
Group	Southeast Conifer & Hardwood Plantation (G029)
Association (Common name)	Loblolly Pine Plantation

ELEMENT CONCEPT

Global Summary: This association represents young, monospecific planted stands of *Pinus taeda* (loblolly pine). Due to the commercial value of this species, this type is widely distributed across much of the southeastern United States from the Interior Highlands to the Coastal Plain, including areas outside the natural range of the species. The core concept of stands attributable to this type are those which support dense, often perfect rows of planted *Pinus taeda* (loblolly pine) or otherwise dense, young stands which are established, managed, and/or maintained for the extraction of forest products (usually pulpwood). In most cases these stands support almost no other tree species in the overstory. Understory composition and density can vary widely depending upon location, management history, and stand age. Stands are typically established with mechanical planting, but may also be established through other means. This association rarely exceeds 20-40 years of age on most timberlands. Excluded from this association are plantation stands which have "broken up" with age or thinning to approximate a more natural structure. Dense planting in rows, if successful, tends to result in nearly complete canopy closure which persists until the stand has either been regenerated or transitions into a different association. Herbaceous ground cover of any kind tends to be sparse due to reduction during site preparation, the typically dense canopy cover, and to the fact that many young plantations are infrequently burned at best.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.
Global Environment: Environmental setting varies widely by site. Stands often occur on level to gently sloping areas, on soils that range from dry to poorly drained.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.
Global Vegetation: There is considerable local variation among stands of this planted vegetation type across its broad range (from the Interior Highlands to the Coastal Plain, including areas outside the natural range of the species). In the Ouachita Mountains planted loblolly is found with a variable amount of *Quercus alba* (white oak), *Quercus falcata* (southern red oak), *Quercus marilandica* (blackjack oak), *Quercus stellata* (post oak), and *Quercus velutina* (black oak); on drier sites *Pinus echinata* (shortleaf pine), *Carya alba* (mockernut hickory), and *Carya texana* (black hickory); and *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), and *Quercus nigra* (water oak) on wetter sites. The understory can be thick especially after thinning and/or burning. Common understory species are *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium arboreum* (farkleberry), *Vaccinium stamineum* (deerberry), *Cornus florida* (flowering dogwood), *Ulmus alata* (winged elm), and others. Vines are an important component, including *Berchemia scandens* (Alabama supplejack), *Lonicera japonica* (Japanese honeysuckle), *Parthenocissus quinquefolia* (Virginia creeper), *Vitis* (grape) spp., *Smilax* (greenbrier) spp., and *Toxicodendron radicans* (eastern poison-ivy). In dense stands the herbaceous layer is suppressed by dense needle litter. In thinned and burned stands the plantations are often grazed. Herbaceous species can include *Solidago ulmifolia* (elmleaf goldenrod), *Chasmanthium sessiliflorum* (longleaf woodoats), *Schizachyrium scoparium* (little bluestem), *Danthonia spicata* (poverty oatgrass), *Tephrosia virginiana* (Virginia tephrosia), *Lespedeza* (lespedeza) spp., *Symphyotrichum patens* (late purple aster), *Eupatorium* (thoroughwort) spp., and others. In Oklahoma, associates include *Rhus copallinum* (winged sumac), *Hypericum densiflorum* (bushy St. Johnswort), *Liquidambar styraciflua* (sweetgum) and *Toxicodendron radicans* (eastern poison-ivy) (Hoagland 2000). Additional data on several stands on the Croatan National Forest can be found in Doyle and Allard (1990).

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CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (cultural) (8-Aug-2000). This community represents vegetation which has been planted in its current location by humans and/or is treated with intensive management or manipulation. It is not a conservation priority and does not receive a conservation rank.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: At Arnold Air Force Base, Coffee and Franklin counties, Tennessee, *Pinus taeda* (loblolly pine) is near the edge of its putative natural range and was apparently absent prior to being planted there between 1945 and 1950 on abandoned agricultural land and along roadsides. Older plantings have not been intensively managed, and many have become "modified" vegetation (e.g., CEGL007109) and are no longer regarded as plantations. More recently (1998-2001) some of these older pine stands have been harvested and replaced with true *Pinus taeda* (loblolly pine) plantations. *Pinus taeda* (loblolly pine) also invades seasonally wet hardwood depressions, but these stands remain recognizable as to their natural identity (e.g., CEGL007364). Associations occur as plantations and on old fields on Kisatchie and Sumter national forests and after blowdowns on the Kisatchie. South Carolina information after Jones et al. (1981b). In the Coastal Plain of South Carolina, there are mature loblolly plantations, often with *Prunus serotina* (black cherry) in the understory, that have been prescribed burned (based on seven plots at Savannah River Site) - such stands are presumably better covered under *Pinus taeda* (loblolly pine) Forest Alliance (A.130). Plantations occur in obvious rows in the aerial photos of the Delmarva Peninsula in Maryland.
Global Similar Associations:
Pinus taeda - Liriodendron tulipifera / Acer saccharum Successional Forest (CEGL007105)
Pinus taeda - Quercus (falcata, hemisphaerica, nigra) - Liquidambar styraciflua / Rhus copallinum - Vaccinium stamineum Forest (CEGL008450)
Pinus taeda / Liquidambar styraciflua - Acer rubrum var. rubrum / Vaccinium stamineum Forest (CEGL006011) develops when stands develop typical two-layered structure with well-developed subcanopy.
Pinus taeda / Rhus copallinum Managed Forest (CEGL007108) may replace this association as stands mature.
Pinus taeda / Saccharum alopecuroidum - (Andropogon spp.) Forest (CEGL007109)
Global Related Concepts:
Loblolly Pine: 81 (Eyre 1980) >

ELEMENT DISTRIBUTION

Buffalo National River Range: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.
Global Range: This association is found throughout the southeastern United States.
Nations: US
States/Provinces: AL, AR, DC?, DE, FL, GA, KY, LA, MD, MS, NC, OK, SC, TN, TX, VA
TNC Ecoregions: 38:C, 39:C, 40:C, 41:C, 42:P, 43:C, 44:C, 50:C, 51:C, 52:C, 53:C, 56:C, 57:C, 58:C, 62:C
USFS Ecoregions (1994/95): 221Hc:CCC, 221He:CCC, 221Jb:CCC, 222C:CC, 222Eg:CCC, 231Aa:CCC, 231Ae:CCC, 231Ak:CCC, 231An:CCC, 231Ba:CCC, 231Bg:CCC, 231Bh:CCC, 231Bi:CCC, 231Bk:CCC, 231Ca:CPP, 231Cd:CPP, 231E:CC, 232Ac:CCC, 232Bm:CCC, 232Bq:CCC, 232Br:CCC, 232Bx:CCC, 232Ca:CCC, 232Cb:CCC, 232Ce:CCC, 234A:CC, M221Cd:CCC, M221D:CC, M222A:CC, M231A:CC
Federal Lands: DOD (Arnold, Fort Benning, Fort Bragg, Fort Gordon, Fort Stewart); DOE (Savannah River Site); NPS (Appomattox Court House, Buffalo River?, C&O Canal, Chickamauga-Chattanooga?, Colonial, Fredericksburg-Spotsylvania, George Washington Birthplace, Mammoth Cave?, Manassas, Moores Creek, Natchez Trace, National Capital-East, Obed River, Petersburg, Richmond, Timucuan?, Vicksburg); USFS (Angelina, Bankhead?, Bienville, Cherokee, Conecuh, Croatan, Davy Crockett, De Soto, Delta, Francis Marion, Holly Springs, Kisatchie, Land Between the Lakes, Oconee, Ouachita, Ouachita (Coastal Plain), Ouachita (Mountains), Ozark, Sabine, Sam Houston, St. Francis?, Sumter, Sumter (Mountains), Sumter (Piedmont), Talladega, Talladega (Oakmulgee), Talladega (Talladega), Tombigbee, Tuskegee); USFWS (Blackwater, Chesapeake Marshlands, Eufaula, Prime Hook)

ELEMENT SOURCES

Buffalo National River Plots: None.
Local Description Authors: M. Pyne
Global Description Authors: A.S. Weakley, mod. L.A. Sneddon
References: ALNHP 2002, Doyle and Allard 1990, Eyre 1980, Hoagland 1998a, Hoagland 2000, Jones et al. 1981b, McCrain and Church 1985, Patterson 2008a, Patterson 2008c, Patterson 2008d, Patterson 2008e, Patterson 2008f, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, TNC 1998a, Taverna and Patterson 2008

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G031. Southeast Hardwood & Conifer Ruderal Forest

Successional Eastern Red-cedar Forest

***Juniperus virginiana var. virginiana - (Quercus* spp.) Forest**
Eastern Red-cedar - (Oak species) Forest
Identifier: CEGL007124

NVC CLASSIFICATION

Division	Southeastern North American Warm Temperate Forest (1.B.1.Na)
Macrogroup	Southeastern North American Ruderal Forest & Plantation (M305)
Group	Southeast Hardwood & Conifer Ruderal Forest (G031)
Association (Common name)	Successional Eastern Red-cedar Forest

ELEMENT CONCEPT

Global Summary: This is a successional community dominated by a nearly monospecific *Juniperus virginiana var. virginiana* (eastern red-cedar) canopy. Species composition and cover are variable depending upon geographic location and disturbance history. Some examples are densely forested (75-100% total cover) with *Juniperus virginiana var. virginiana* (eastern red-cedar) and sparse subcanopy, shrub and herb strata. Other examples, especially those that are somewhat more open-canopied, are more species-rich, and other tree species may enter the canopy in low levels of abundance. Species that may occur in the canopy include *Carya alba* (mockernut hickory), *Carya carolinae-septentrionalis* (southern shagbark hickory), *Carya ovata* (shagbark hickory), *Cercis canadensis* (eastern redbud), and *Pinus virginiana* (Virginia pine). Various oaks (including *Quercus coccinea* (scarlet oak), *Quercus falcata* (southern red oak), *Quercus stellata* (post oak), and *Quercus phellos* (willow oak)) may also be present, seeding in from adjacent oak-hardwood forests. The midstory is typically sparse, with canopy species as well as *Cornus florida* (flowering dogwood), *Ilex opaca* (American holly), *Liquidambar styraciflua* (sweetgum), and *Prunus serotina var. serotina* (black cherry). In addition, *Frangula caroliniana* (Carolina buckthorn) occurs in various strata. Herbs are patchy and typically include *Asplenium platyneuron* (ebony spleenwort), *Chasmanthium laxum* (slender woodoats), *Eupatorium* (thoroughwort) spp., *Polystichum acrostichoides* (Christmas fern), and *Carex* (sedge) spp.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This successional eastern red-cedar forest was sampled at nine locations in the park. Many of the sites are successional old fields. Sites include gentle to somewhat steep mid and lower slopes of any aspect as well as flat lowlands. Soils are variable, ranging from xeric to dry-mesic moderately well-drained clay loam to rapidly to well-drained sandy loam to somewhat poorly drained sand. The unvegetated surface is dominated by leaf litter (40-99% cover) with some large rocks (0-20%), small rocks (0-10%), wood (0-10%) and bare soil (0-20%); one site has 30% cover of bedrock. Evidence of disturbance includes past clearing, trails, fire scars, fire suppression and the presence of many invasive exotic plant species.
Global Environment: This community occurs in both coastal plain and interior regions of the southeastern United States in a variety of disturbed areas such as eroded soils on abandoned agricultural land (Andreu and Tukman 1995). In Kentucky, this vegetation occurs throughout the state (Bluegrass region, Highland Rim, East Gulf Coastal Plain) on calcareous substrates or on abandoned agricultural land; acreage of this type has increased since presettlement times. This type also includes the *Juniperus virginiana var. virginiana* (eastern red-cedar) woodland from Tellico Lake (Andreu and Tukman 1995) which occurs on drier sites with shallow, rocky soils.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The very sparse to very dense (5-90% cover) tree canopy ranges from 10-20 m tall and is dominated by *Juniperus virginiana* (eastern red-cedar). The canopy is typically single-tiered but may include both a canopy and subcanopy, either of which may dominate. The tall-shrub layer may also form a two-tiered structure with the canopy, and it too can dominate the structure of the stand. Additional tree species include mostly *Carya* (hickory) spp. and *Quercus* (oak) spp.; tall shrubs include *Juniperus virginiana* (eastern red-cedar), *Celtis tenuifolia* (dwarf hackberry), *Ostrya virginiana* (hophornbeam), *Quercus falcata* (southern red oak), *Quercus muehlenbergii* (chinkapin oak), and *Ulmus alata* (winged elm). The short-shrub layer (0.5-1 m) is generally much sparser (5-60%) and may include *Celtis tenuifolia* (dwarf hackberry), *Cercis canadensis* (eastern redbud), *Diospyros virginiana* (common persimmon), *Frangula caroliniana* (Carolina buckthorn), *Fraxinus americana* (white ash), *Quercus* (oak) spp., *Symphoricarpos orbiculatus* (coralberry), and *Viburnum rufidulum* (rusty blackhaw), among others. The highly variable (5-80%) herbaceous layer is dependent on the density of the upper layers. Dominants can include *Toxicodendron radicans* (eastern poison-ivy), *Aira caryophyllea* (silver hairgrass), *Astranthium integrifolium ssp. ciliatum* (entireleaf western daisy), *Lespedeza* (lespedeza) spp., *Desmodium* (ticktrefoil) spp., *Dichanthelium* (rosette grass) spp., *Danthonia spicata* (poverty oatgrass), and *Chasmanthium latifolium* (Indian woodoats). Common vines include *Parthenocissus quinquefolia* (Virginia creeper) and *Smilax bona-nox* (saw greenbrier). Nineteen exotic species were recorded. However, sites may also support state-vulnerable *Juniperus ashei* (Ashe's juniper).
Global Vegetation: Stands are dominated by *Juniperus virginiana var. virginiana* (eastern red-cedar). A host of other woody species may also be present, some of which may occur in the canopy at low levels of abundance. These species include *Carya alba* (mockernut hickory), *Carya ovata* (shagbark hickory), *Cercis canadensis* (eastern redbud), *Pinus virginiana* (Virginia pine), *Quercus coccinea* (scarlet oak), *Quercus falcata* (southern red oak), and *Quercus phellos* (willow oak). The midstory is typically sparse, with

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canopy species as well as *Cornus florida* (flowering dogwood), *Ilex opaca* (American holly), *Liquidambar styraciflua* (sweetgum), and *Prunus serotina var. serotina* (black cherry) (NatureServe Ecology unpubl. data). In addition, *Frangula caroliniana* (Carolina buckthorn) occurs in various strata. Herbs are patchy and typically include *Asplenium platyneuron* (ebony spleenwort), *Chasmanthium laxum* (slender woodoats), *Eupatorium* (thoroughwort) spp., *Polystichum acrostichoides* (Christmas fern), and *Carex* (sedge) spp. The ground layers of some stands may exhibit dominance by native warm-season grasses and other graminoids, including *Schizachyrium scoparium* (little bluestem), *Andropogon* (bluestem) spp., and *Danthonia* (oatgrass) spp. The exotics *Lonicera japonica* (Japanese honeysuckle) and *Microstegium vimineum* (Nepalese browntop) may also be present.

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Juniperus virginiana* (eastern red-cedar)
Herb (field)	Forb	*Lespedeza cuneata* (sericea lespedeza), *Toxicodendron radicans* (eastern poison-ivy)
Herb (field)	Graminoid	*Danthonia spicata* (poverty oatgrass)

Global

Stratum	Lifeform	Species
Tree subcanopy	Needle-leaved tree	*Juniperus virginiana* var. *virginiana* (eastern red-cedar)

CHARACTERISTIC SPECIES

Buffalo National River: *Danthonia spicata* (poverty oatgrass), *Juniperus virginiana* (eastern red-cedar), *Lespedeza cuneata* (sericea lespedeza), *Toxicodendron radicans* (eastern poison-ivy)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Juniperus ashei* (Ashe's juniper, state-vulnerable, G5); **Exotic/Invasive**: *Aira caryophyllea* (silver hairgrass, exotic, Medium/Insignificant), *Bromus commutatus* (meadow brome, exotic, Unknown), *Bromus japonicus* (Japanese brome, exotic), *Daucus carota* (Queen Anne's lace, exotic, Low), *Dianthus armeria* (Deptford pink, exotic, Low/Insignificant), *Lamium purpureum* (purple deadnettle, exotic), *Lespedeza cuneata* (sericea lespedeza, exotic, Medium), *Leucanthemum vulgare* (oxeye daisy, exotic, Medium/Low), *Lolium arundinaceum* (tall fescue, exotic, High/Medium), *Lonicera japonica* (Japanese honeysuckle, exotic, High/Medium), *Melilotus officinalis* (yellow sweetclover, exotic, Medium/Low), *Plantago lanceolata* (narrowleaf plantain, exotic, High/Low), *Rosa multiflora* (multiflora rose, exotic, Medium/Low), *Rumex acetosella* (common sheep sorrel, exotic, Medium/Low), *Stellaria media* (common chickweed, exotic, Low), *Taraxacum officinale* (common dandelion, exotic), *Trifolium campestre* (field clover, exotic), *Trifolium dubium* (suckling clover, exotic), *Trifolium repens* (white clover, exotic, Medium/Low)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (3-Sep-2002). This forest represents early-successional, modified, or silviculturally managed vegetation and is thus not of conservation concern and does not receive a conservation status rank.

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Global Comments: Originally described from Tellico Pilot Project (Ridge and Valley of Tennessee, northeastern Monroe County) based on 10 stands sampled by Andreu and Tukman (1995). This community is very closely related to *Juniperus virginiana* (eastern red-cedar) Woodland and to mixed juniper-oak forest types but is distinguished by the closed-canopy evergreen dominance of *Juniperus virginiana* (eastern red-cedar). *Juniperus virginiana* (eastern red-cedar) woodlands may be equivalent to this type.
Global Similar Associations:
Juniperus virginiana Midwest Forest (CEGL002593)
Juniperus virginiana var. virginiana / Rhus copallinum / Schizachyrium scoparium Woodland (CEGL007704)
Global Related Concepts:
CT VI *Juniperus virginiana, Pinus virginiana, Cornus florida, Carya glabra* (Badger et al. 1997) ><
CT VII *Juniperus virginiana, Liriodendron tulipifera, Quercus imbricaria, Quercus velutina* (Badger et al. 1997) ><
Eastern Redcedar: 46 (Eyre 1980) >
IB5a. Eastern Red Cedar Woodland (Allard 1990) **?**
Red cedar, RV (Pyne 1994) >

ELEMENT DISTRIBUTION

Buffalo National River Range: This successional eastern red-cedar forest was sampled near Whiteley School, Buffalo Point, Turkey Mountain in Lower Buffalo Wilderness, near Pruitt Bridge and Arnold Cemetery.
Global Range: This community is widely distributed in both coastal plain and interior regions of the southeastern United States, ranging in the interior to Oklahoma, Kentucky, and West Virginia.
Nations: US

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States/Provinces: AL, AR, GA, KY, LA, MS, NC, OK, SC, TN, VA, WV?
TNC Ecoregions: 38:C, 39:P, 43:C, 44:C, 50:C, 51:?, 52:?, 53:P, 59:C
USFS Ecoregions (1994/95): 221Hc:CCC, 222Ak:CCP, 222Cg:CCC, 222Dg:CCC, 222Eb:CCC, 222Ed:CCC, 222Ef:CCC, 222Eg:CCC, 222Ej:CCC, 222En:CCC, 222Eo:CCC, 222Lc:CCP, 222Me:CCP, 231Ba:CCC, 231Bd:CCC, 231Be:CCC, 231Cd:CCC, 251Cc:CC?, 251Ch:CCP, M221Be:CCC, M222Aa:CCC
Federal Lands: DOD (Arnold, Camp Gruber, J. Percy Priest); NPS (Abe Lincoln Birthplace, Big South Fork, Buffalo River, Chickamauga-Chattanooga, Chickasaw NRA, Cumberland Gap, Fort Donelson, Kings Mountain, Mammoth Cave, Natchez Trace, Russell Cave, Shiloh, Stones River); TVA (Columbia, Tellico); USFS (Bankhead, Cherokee?, Daniel Boone, Ouachita (Mountains)?, Ouachita?, Ozark)

ELEMENT SOURCES

Buffalo National River Plots: (9 plots): BUFF.007, BUFF.086, BUFF.168, BUFF.190, BUFF.211, BUFF.221, BUFF.224, BUFF.750, BUFF.751.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: K.D. Patterson, mod. M. Pyne
References: Allard 1990, Andreu and Tukman 1995, Badger et al. 1997, Evans 1991, Eyre 1980, Gallyoun et al. 1996, Hoagland 2000, NatureServe Ecology - Southeastern U.S. unpubl. data, Nordman 2004, Pyne 1994, Rice 1960, Rosson 1995, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, Whited pers. comm.

Red-cedar - Pine - Elm Successional Ozark Forest

***Juniperus virginiana var. virginiana - Pinus echinata - Ulmus alata / Rhus glabra* Forest**
Eastern Red-cedar - Shortleaf Pine - Winged Elm / Smooth Sumac Forest
Identifier: CEGL007816

NVC CLASSIFICATION

Division	Southeastern North American Warm Temperate Forest (1.B.1.Na)
Macrogroup	Southeastern North American Ruderal Forest & Plantation (M305)
Group	Southeast Hardwood & Conifer Ruderal Forest (G031)
Association (Common name)	Red-cedar - Pine - Elm Successional Ozark Forest

ELEMENT CONCEPT

Global Summary: This forest is a widespread successional forest in the Ozark and central Ouachita region, developing from formerly pastured (and maybe also farmed) lands. *Pinus echinata* (shortleaf pine), *Juniperus virginiana var. virginiana* (eastern red-cedar), and *Ulmus alata* (winged elm) are the dominant trees. Canopy closure is variable (depending on age) and can be open to closed. Especially in the more open occurrences, *Rhus glabra* (smooth sumac) and *Rhus copallinum* (winged sumac) can be common shrubs. *Schizachyrium scoparium var. scoparium* (little bluestem) and other grasses may be common.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.
Global Environment: This forest is a widespread successional forest in the Ozark and central Ouachita region, developing from formerly pastured (and maybe also farmed) lands.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.
Global Vegetation: *Pinus echinata* (shortleaf pine), *Juniperus virginiana var. virginiana* (eastern red-cedar), and *Ulmus alata* (winged elm) are the dominant trees in stands of this type. Canopy closure is variable (depending on age) and can be open to closed. Especially in the more open occurrences, *Rhus glabra* (smooth sumac) and *Rhus copallinum* (winged sumac) can be common shrubs. *Schizachyrium scoparium var. scoparium* (little bluestem) and other grasses may be common.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (modified/managed) (30-Nov-1998). This forest is a widespread successional forest in the Ozark and central Ouachita regions and may occur elsewhere in the southeastern United States.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: Alliance placement is uncertain. Examples of this community are restorable with the introduction of fire (D. Zollner pers. comm.).

ELEMENT DISTRIBUTION

Buffalo National River Range: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.

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Global Range: This forest is a widespread successional forest in the Ozark and central Ouachita region and may occur elsewhere in the southeastern United States.
Nations: US
States/Provinces: AR, OK?
TNC Ecoregions: 38:C, 39:C
USFS Ecoregions (1994/95): 222Ab:CCC, 222Ag:CCC, 222An:CCC, 231Aa:CCC, 231Gb:CCC
Federal Lands: NPS (Buffalo River?); USFS (Ouachita, Ouachita (Mountains), Ozark)

ELEMENT SOURCES

Buffalo National River Plots: None.
Local Description Authors: M. Pyne
Global Description Authors: A.S. Weakley
References: Southeastern Ecology Working Group n.d.

Interior Mid- to Late-Successional Sweetgum - Oak Forest

***Liquidambar styraciflua - Quercus (alba, falcata)* Forest**
Sweetgum - (White Oak, Southern Red Oak) Forest
Identifier: CEGL007217

NVC CLASSIFICATION

Division	Southeastern North American Warm Temperate Forest (1.B.1.Na)
Macrogroup	Southeastern North American Ruderal Forest & Plantation (M305)
Group	Southeast Hardwood & Conifer Ruderal Forest (G031)
Association (Common name)	Interior Mid- to Late-Successional Sweetgum - Oak Forest

ELEMENT CONCEPT

Global Summary: Stands of this successional forest association are dominated by *Liquidambar styraciflua* (sweetgum) but also support additional species in the overstory such as *Quercus alba* (white oak), *Liriodendron tulipifera* (tuliptree), and/or *Quercus falcata* (southern red oak). This forest is somewhat later successional and/or more diverse than pure *Liquidambar styraciflua* (sweetgum) forests [see *Liquidambar styraciflua* (sweetgum) Forest (CEGL007216)]. This type may arise following disturbance of mixed *Quercus* - *Carya* forests. This vegetation type would be more prevalent or more likely to be encountered to the north of the range of *Quercus nigra* (water oak), i.e., in the interior and Piedmont rather than in the Coastal Plain.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This successional sweetgum - oak forest was sampled at six locations in the park. Sites range from a flat stream terrace to a moderate southwest-facing midslope bench to somewhat steep to steep, south-, southeast- and northeast-facing mid- and toeslopes. Soils are generally dry-mesic and range from rapidly drained to moderately well-drained sand, sandy loam and silt loam. The unvegetated surface is made up of leaf litter (40-98% cover), with some large rocks (0-35%), small rocks (0-35%), wood (1-15%), and bare soil (0-2%). Evidence of disturbance includes past fire, roads and trails, and the presence of exotic plants.
Global Environment: This type may arise following disturbance of mixed *Quercus* - *Carya* forests. This vegetation type would be more prevalent or more likely to be encountered to the north of the range of *Quercus nigra* (water oak), i.e., in the interior and Piedmont rather than in the Coastal Plain.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The moderately dense to dense (70-90% cover) tree canopy, 15-35 m tall, is dominated by *Liquidambar styraciflua* (sweetgum) and *Quercus alba* (white oak); additional species may include *Acer saccharum* (sugar maple), *Carya cordiformis* (bitternut hickory), *Carya ovata* (shagbark hickory), *Carya texana* (black hickory), *Juglans nigra* (black walnut), *Nyssa sylvatica* (blackgum), *Quercus falcata* (southern red oak), *Quercus rubra* (northern red oak), and *Quercus velutina* (black oak). The sparse to dense (30-80%) subcanopy (10-15 m) is also dominated by *Liquidambar styraciflua* (sweetgum) and includes other canopy species. The very sparse to very dense (5-90%) tall-shrub layer (2-5 m) and very sparse to moderate (5-50%) short-shrub layer (0.5-1 m) are made up of saplings of canopy species as well as *Amelanchier arborea* (common serviceberry), *Asimina triloba* (pawpaw), *Carya cordiformis* (bitternut hickory), *Castanea pumila var. ozarkensis* (Ozark chinkapin) (globally and state-vulnerable), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Frangula caroliniana* (Carolina buckthorn), *Fraxinus americana* (white ash), *Morus rubra* (red mulberry), *Ostrya virginiana* (hophornbeam), *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), *Sideroxylon lanuginosum* (gum bully), *Symphoricarpos orbiculatus* (coralberry), and *Viburnum rufidulum* (rusty blackhaw). The herbaceous layer may be very sparse or may form continuous cover (5-100%); dominant species include *Amphicarpaea bracteata* (American hogpeanut), *Dichanthelium boscii* (Bosc's panicgrass), and *Toxicodendron radicans* (eastern poison-ivy). Other common herbs include *Cynoglossum virginianum* (wild comfrey), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dioscorea villosa* (wild yam), *Galium circaezans* (licorice bedstraw), *Parthenocissus quinquefolia* (Virginia creeper), *Podophyllum peltatum* (mayapple), *Sanicula canadensis* (Canadian blacksnakeroot),

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and *Viola sororia* (common blue violet). This community also supports state-imperiled *Carex mesochorea* (midland sedge) and *Carex laevivaginata* (smoothsheath sedge).

Global Vegetation: The overstory of stands of this association are usually dominated by *Liquidambar styraciflua* (sweetgum), but may also support other species such as *Quercus alba* (white oak), *Liriodendron tulipifera* (tuliptree), and *Quercus falcata* (southern red oak). Other woody species encountered in plots attributed to this type include *Fraxinus americana* (white ash), *Cornus florida* (flowering dogwood), *Diospyros virginiana* (common persimmon), *Quercus velutina* (black oak), *Quercus rubra* (northern red oak), and *Carya* (hickory) spp. (NatureServe Ecology unpubl. data).

At Shiloh National Military Park, this vegetation is documented from a plot (SHIL.4) which was disturbed by a tornado in 1971 or 1972 (D. Turnbo pers. comm. 2003). There are stumps and tip-up mounds from the tornado and the salvage logging which followed. The dominant tree is *Liquidambar styraciflua* (sweetgum) with *Acer rubrum* (red maple) canopy subdominant. *Carya alba* (mockernut hickory) and *Quercus alba* (white oak) are also important, with *Quercus falcata* (southern red oak), *Prunus serotina* (black cherry), *Nyssa sylvatica* (blackgum), and *Carya glabra* (pignut hickory). *Cornus florida* (flowering dogwood), *Carya pallida* (sand hickory), and *Quercus rubra* (northern red oak) are important primarily in the subcanopy and tall-shrub strata. *Vaccinium stamineum* (deerberry) and *Ilex decidua* (possum-haw) are tall shrubs; most of the *Quercus* (oak) spp. and *Carya* (hickory) spp. also occur as tall shrubs. Short shrubs include *Quercus phellos* (willow oak), *Ulmus alata* (winged elm), *Rosa carolina* (Carolina rose), *Vitis rotundifolia* (muscadine), *Lonicera japonica* (Japanese honeysuckle), *Mimosa microphylla* (littleleaf sensitive-briar), *Hypericum hypericoides* (St. Andrew's cross), *Juniperus virginiana* (eastern red-cedar), *Ligustrum sinense* (Chinese privet), *Vaccinium stamineum* (deerberry), *Diospyros virginiana* (common persimmon), *Nyssa sylvatica* (blackgum), *Smilax glauca* (cat greenbrier), *Carya glabra* (pignut hickory), *Vaccinium arboreum* (farkleberry), and *Rubus argutus* (sawtooth blackberry). The herbaceous stratum has 30% cover, but there are no dominant species. The most abundant herbaceous species are *Dichanthelium boscii* (Bosc's panicgrass) and *Botrychium biternatum* (sparselobe grapefern). Other herbaceous species are *Scutellaria elliptica* (hairy skullcap), *Houstonia purpurea* (Venus' pride), *Elephantopus tomentosus* (devil's grandmother), *Asplenium platyneuron* (ebony spleenwort), *Polystichum acrostichoides* (Christmas fern), *Dichanthelium laxiflorum* (openflower rosette grass), *Viola X palmata* (early blue violet), *Galium circaezans* (licorice bedstraw), *Sanicula canadensis* (Canadian blacksnakeroot), *Athyrium filix-femina ssp. asplenioides* (asplenium ladyfern), *Conoclinium coelestinum* (blue mistflower), *Lobelia puberula* (downy lobelia), *Cirsium horridulum* (yellow thistle), *Lycopodium digitatum* (fan clubmoss), *Chasmanthium laxum* (slender woodoats), *Lespedeza repens* (creeping lespedeza), *Ruellia strepens* (limestone wild petunia), and *Pycnanthemum verticillatum var. pilosum* (whorled mountainmint).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple), *Carya cordiformis* (bitternut hickory), *Liquidambar styraciflua* (sweetgum), *Nyssa sylvatica* (blackgum), *Quercus alba* (white oak)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Ostrya virginiana* (hophornbeam)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Carpinus caroliniana* (American hornbeam), *Cornus florida* (flowering dogwood), *Liquidambar styraciflua* (sweetgum), *Morus rubra* (red mulberry)
Herb (field)	Forb	*Amphicarpaea bracteata* (American hogpeanut), *Toxicodendron radicans* (eastern poison-ivy)
Herb (field)	Graminoid	*Dichanthelium boscii* (Bosc's panicgrass)

Global

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Liquidambar styraciflua* (sweetgum)

CHARACTERISTIC SPECIES

Buffalo National River: *Acer saccharum* (sugar maple), *Amphicarpaea bracteata* (American hogpeanut), *Carpinus caroliniana* (American hornbeam), *Carya cordiformis* (bitternut hickory), *Cornus florida* (flowering dogwood), *Dichanthelium boscii* (Bosc's panicgrass), *Liquidambar styraciflua* (sweetgum), *Morus rubra* (red mulberry), *Nyssa sylvatica* (blackgum), *Ostrya virginiana* (hophornbeam), *Quercus alba* (white oak), *Toxicodendron radicans* (eastern poison-ivy)
Global: *Liquidambar styraciflua* (sweetgum)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Carex laevivaginata* (smoothsheath sedge, state-imperiled, G5), *Carex mesochorea* (midland sedge, state-imperiled, G4G5); **Exotic/Invasive**: *Cardamine hirsuta* (hairy bittercress, exotic), *Lonicera japonica* (Japanese honeysuckle, exotic, High/Medium), *Rosa multiflora* (multiflora rose, exotic, Medium/Low)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (8-Aug-2000). This forest represents successional vegetation. Consequently it is not of conservation concern and does not receive a conservation status rank.

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CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Global Comments: This community is composed of at least 40% *Liquidambar styraciflua* (sweetgum) in the canopy, but it differs from earlier successional *Liquidambar styraciflua* (sweetgum) in that it has a minor or major component of oaks and hickories and other later-successional trees in the subcanopy and canopy. However, unlike less-disturbed, more natural *Liquidambar styraciflua* (sweetgum) types, it is not located in a floodplain and it has a very low-diversity herbaceous layer.
Global Similar Associations:
Liquidambar styraciflua - Carya illinoinensis - Quercus nigra Forest (CEGL004122)
Liquidambar styraciflua - Quercus (nigra, phellos) - Pinus taeda / Vaccinium elliottii - Morella cerifera Forest (CEGL007726) which is more likely and more prevalent in the southern Coastal Plain.
Liquidambar styraciflua Forest (CEGL007216) terms (prior to the appearance of oak saplings in the canopy and subcanopy).

ELEMENT DISTRIBUTION

Buffalo National River Range: This successional sweetgum - oak forest was sampled near the Whiteley School, along the Indian Rockhouse Trail and Spring Hollow Trail, near Rush Landing and Pruitt Landing.
Global Range: This early-successional sweetgum forest has been defined from the Interior Highlands of the central United States and from the Piedmont of the southeastern United States, and is also reported for the Southern Ridge and Valley, but is likely much more widespread.
Nations: US
States/Provinces: AL, AR, GA, MS, SC, TN
TNC Ecoregions: 38:C, 39:C, 43:C, 44:C, 50:C, 52:C
USFS Ecoregions (1994/95): 222Ag:CCC, 222An:CCC, 222Cg:CCC, 222Ef:CCC, 222Eg:CCC, 231Ab:CCC, 231Ba:CCC, 231Cc:CCC, M222Aa:CCC, M231A:CC
Federal Lands: NPS (Buffalo River, Chickamauga-Chattanooga, Fort Donelson, Horseshoe Bend, Mammoth Cave?, Natchez Trace, Shiloh); USFS (Delta?, Holly Springs, Oconee?, Ouachita, Ouachita (Mountains), Ozark, Talladega (Oakmulgee)?, Talladega (Talladega)?, Talladega?, Tombigbee?, Tuskegee?)

ELEMENT SOURCES

Buffalo National River Plots: (7 plots): BUFF.005, BUFF.078, BUFF.103, BUFF.145, BUFF.172, BUFF.202, BUFF.220.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: R.E. Evans, mod. C.W. Nordman
References: Gallyoun et al. 1996, NatureServe Ecology - Southeastern U.S. unpubl. data, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, Turnbo pers. comm.

Osage-orange Successional Forest

***Maclura pomifera* Semi-natural Forest**
Osage-orange Semi-natural Forest
Identifier: CEGL006627

NVC CLASSIFICATION

Division	Southeastern North American Warm Temperate Forest (1.B.1.Na)
Macrogroup	Southeastern North American Ruderal Forest & Plantation (M305)
Group	Southeast Hardwood & Conifer Ruderal Forest (G031)
Association (Common name)	Osage-orange Successional Forest

ELEMENT CONCEPT

Global Summary: This *Maclura pomifera* (osage orange) semi-natural forest is found locally throughout the eastern United States. Stands often establish on old fields abandoned after agricultural cropping or pasturing or around old homesites. In some areas it occurs on post-agricultural floodplain terraces. This vegetation has also become established following the planting of *Maclura pomifera* (osage orange) to stabilize and enrich nutrient-poor soils that are subject to erosion. The vegetation is dominated by *Maclura pomifera* (osage orange). Associated woody species vary from site to site and include *Prunus serotina* (black cherry), *Juniperus virginiana* (eastern red-cedar), *Ulmus alata* (winged elm), *Ulmus americana* (American elm), *Ulmus rubra* (slippery elm), *Carya ovata* (shagbark hickory), *Celtis occidentalis* (common hackberry), *Juglans nigra* (black walnut), *Quercus falcata* (southern red oak), and *Ulmus rubra* (slippery elm). Understory vegetation is highly variable depending on site history and often includes *Toxicodendron radicans* (eastern poison-ivy). The invasive non-native *Rosa multiflora* (multiflora rose) may be present as a shrub, along with the non-native bramble *Rubus phoenicolasius* (wine raspberry).

ENVIRONMENTAL DESCRIPTION

Global Environment: This type often establishes on old fields abandoned after agricultural cropping or pasturing or around old home sites. *Maclura pomifera* (osage orange) thickets are characteristically found along fencerows, ditch banks, ravines, and around abandoned farmsteads.

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VEGETATION DESCRIPTION

Global Vegetation: The vegetation is dominated by *Maclura pomifera* (osage orange) forming a partial to nearly complete canopy. Associated woody species vary from site to site and include *Prunus serotina* (black cherry), *Juniperus virginiana* (eastern red-cedar), *Ulmus alata* (winged elm), *Ulmus americana* (American elm), *Ulmus rubra* (slippery elm), *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), *Carya ovata* (shagbark hickory), *Celtis occidentalis* (common hackberry), *Juglans nigra* (black walnut), *Quercus falcata* (southern red oak), *Quercus rubra* (northern red oak), the exotic *Ailanthus altissima* (tree of heaven), and in some areas *Acer platanoides* (Norway maple). Understory vegetation is highly variable depending on site history and often includes *Toxicodendron radicans* (eastern poison-ivy); *Lindera benzoin* (northern spicebush) is sometimes present. The invasive non-natives *Rosa multiflora* (multiflora rose) and *Elaeagnus umbellata* (autumn olive) are typically the most common shrubs, along with the non-native bramble *Rubus phoenicolasius* (wine raspberry). *Cornus florida* (flowering dogwood) may be present in the subcanopy. Non-native species such as *Alliaria petiolata* (garlic mustard), *Chelidonium majus* (celandine), *Glechoma hederacea* (ground ivy), *Dactylis glomerata* (orchardgrass), *Daucus carota* (Queen Anne's lace), and *Convallaria majalis* (European lily of the valley) can characterize the herb layer, which may have a native component as well, for example with (depending on geography) *Ageratina altissima* (white snakeroot), *Dichanthelium clandestinum* (deertongue), *Elymus hystrix var. hystrix* (eastern bottlebrush grass), *Leersia virginica* (whitegrass), *Parthenocissus quinquefolia* (Virginia creeper), *Pilea pumila* (Canadian clearweed), *Solidago canadensis* (Canada goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), *Verbesina alternifolia* (wingstem), *Verbesina occidentalis* (yellow crownbeard), and *Viola* (violet) spp.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (10-May-2011). Although *Maclura pomifera* (osage orange) is a native species found in the Ozarks and adjacent Arkansas coastal plains, it does not typically become a dominant species in these natural habitats. It is now widespread in the southeastern U.S. in disturbed habitats. This forest represents early-successional vegetation and is thus not of high conservation concern and does not receive a conservation status rank.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Similar Associations:
Juniperus virginiana - Maclura pomifera / Bouteloua curtipendula - Thelesperma filifolium - Packera tampicana Wooded Herbaceous Vegetation (CEGL007812)
Maclura pomifera - Diospyros virginiana / Glyceria striata - (Carex cherokeensis) Woodland (CEGL007779) a natural woodland.

ELEMENT DISTRIBUTION

Global Range: This osage-orange semi-natural forest is found locally throughout the eastern United States. Osage-orange occurred historically in the Red River drainage of Oklahoma, Texas, and Arkansas and in the Blackland Prairies, Post Oak Savannas, and Chisos Mountains of Texas. The full range of this ruderal vegetation is not known, but the commercial range of the species includes most of the United States east of the Rocky Mountains, south of the Platte River, and the Great Lakes, excluding the Appalachian Mountains (Burton 1990). It has been widely naturalized in the United States and Ontario, Canada, as well as being occasionally planted.
Nations: US
States/Provinces: AR, GA, KY?, OK, TN
TNC Ecoregions: 38:C, 39:C, 43:?, 44:C, 50:?, 52:C
Federal Lands: NPS (Buffalo River); USFS (Ouachita?, Ozark?)

ELEMENT SOURCES

Local Description Authors:
Global Description Authors: M. Pyne
References: Burns and Honkala 1990b, Burton 1990, Foti pers. comm., Hurt n.d., Southeastern Ecology Working Group n.d.

Early-Successional Shortleaf Pine Forest

***Pinus echinata* Early-Successional Forest**
Shortleaf Pine Early-Successional Forest
Identifier: CEGL006327

NVC CLASSIFICATION

Division	Southeastern North American Warm Temperate Forest (1.B.1.Na)
Macrogroup	Southeastern North American Ruderal Forest & Plantation (M305)
Group	Southeast Hardwood & Conifer Ruderal Forest (G031)
Association (Common name)	Early-Successional Shortleaf Pine Forest

ELEMENT CONCEPT

Global Summary: This association represents early-successional *Pinus echinata* (shortleaf pine)-dominated vegetation. This broadly defined type has a wide distribution throughout the native range of *Pinus echinata* (shortleaf pine) where it may develop under a

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variety of circumstances associated with severe natural and/or anthropogenic disturbance. It is most frequently associated with abandoned agricultural land, unmanaged clearcuts, and burned or heavily eroded areas, where adjacent *Pinus echinata* (shortleaf pine) are able to seed into the newly disturbed area and colonize before other species such as *Pinus taeda* (loblolly pine). These are considered semi-natural forests as they typically result from anthropogenic disturbances that fundamentally alter the vegetation structure, floristic composition, and often the physical and chemical structure of the soil. Vegetation tends to be dense with a moderately to extremely barren understory. While *Pinus echinata* (shortleaf pine) is clearly the single most dominant tree, other "old-field" *Pinus* (pine) species (e.g., *Pinus taeda* (loblolly pine), *Pinus virginiana* (Virginia pine)) and/or other early-successional deciduous trees (e.g., *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree)) may also be present. Associated woody and herbaceous species vary with geography but are typically ruderal or exotic species. As these forests age, mid-successional species such as *Quercus* (oak) spp. and *Carya* (hickory) spp. may begin to replace senescent *Pinus echinata* (shortleaf pine) individuals.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.

Global Environment: This broadly defined type may develop under a variety of circumstances associated with severe natural and/or anthropogenic disturbance. It is most frequently associated with abandoned agricultural land, unmanaged clearcuts, and burned or eroded areas. These are considered semi-natural forests as they typically result from anthropogenic disturbances which fundamentally alter the vegetation structure, floristic composition, and often the physical and chemical structure of the soil.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.

Global Vegetation: *Pinus echinata* (shortleaf pine) is clearly the single most dominant tree. In addition, other "old-field" *Pinus* (pine) species (e.g., *Pinus taeda* (loblolly pine), *Pinus virginiana* (Virginia pine)) and/or other early-successional deciduous trees (e.g., *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree)) may also be present. Forests of 50+ years may begin to become codominated by mid-successional species such as *Quercus* (oak) spp. and *Carya* (hickory) spp. in some instances. Associated woody and herbaceous species vary with geography but are typically ruderal or exotic species.

MOST ABUNDANT SPECIES

Global

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus echinata* (shortleaf pine)

CHARACTERISTIC SPECIES

Global: *Pinus echinata* (shortleaf pine)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (3-Apr-2000). This forest represents a ruderal community resulting from succession following anthropogenic disturbance of an area. It is not of conservation concern and does not receive a conservation status rank. Stands have suffered some damage from the southern pine beetle (*Dendroctonus frontalis*).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: In Kentucky, this vegetation is known only from the eastern part of the state. A stand at Mammoth Cave National Park which is referred here may have originated with the planting of *Pinus echinata* (shortleaf pine). In Louisiana, this successional vegetation occurs in the Florida parishes and may have a dense shrub understory. In Arkansas, old fields succeed to *Pinus echinata* (shortleaf pine). Stands have suffered some damage from southern pine beetle (*Dendroctonus frontalis*).

Global Similar Associations:

Pinus taeda - Liquidambar styraciflua Semi-natural Forest (CEGL008462) is commonly found in the same area as CEGL006327 in the Piedmont. CEGL008462 contains at least 50% *Pinus taeda* in the canopy, whereas CEGL006327 is mostly *Pinus echinata*.

Pinus taeda / Liquidambar styraciflua - Acer rubrum var. rubrum / Vaccinium stamineum Forest (CEGL006011) occurs in similar environments with similar disturbance histories but is dominated by (>50% of canopy) *Pinus taeda* instead of *Pinus echinata*.

Pinus virginiana - Pinus (rigida, echinata) - (Quercus prinus) / Vaccinium pallidum Forest (CEGL007119) can have a very similar canopy in the Piedmont and Blue Ridge ecoregions, but CEGL007119 is generally created and maintained by fire and/or logging but not heavy plowing and/or erosion. CEGL006327 generally has signs of heavy agricultural use such as sparse herbaceous or shrub layers, large percentage of invasive exotics such as *Lonicera japonica* in the herbaceous layer, old plowlines, human debris, and extremely even-aged canopy, whereas CEGL007119 generally has a more intact herbaceous/shrub layer (especially *Vaccinium pallidum*) and less signs of severe human disturbance.

Pinus virginiana Successional Forest (CEGL002591) occurs in similar environments but is dominated (>50% of canopy) by *Pinus virginiana* instead of *Pinus echinata*.

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Global Related Concepts:
IA7a. Xeric Shortleaf Pine - Oak Forest (Allard 1990) >
T1A9bI1a. *Pinus echinata* (Foti et al. 1994) **?**

ELEMENT DISTRIBUTION

Buffalo National River Range: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.
Global Range: This community is found throughout the southeastern United States.
Nations: US
States/Provinces: AL, AR, GA, KY, LA, MO, MS, NC, OK, SC, TN, TX, WV?
TNC Ecoregions: 38:C, 39:C, 40:C, 43:C, 44:C, 50:C, 51:C, 52:C, 53:C, 59:C
USFS Ecoregions (1994/95): 221J:CC, 222A:CC, 222Dg:CCC, 231A:CC, 231Bd:CCC, 231Cc:CCC, 231E:CP, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Bm:CCC, M221A:C?, M221B:C?, M221Dd:CCC, M222A:CC
Federal Lands: BIA (Eastern Band of Cherokee); NPS (Buffalo River?, Cowpens, Fort Donelson, Kennesaw Mountain, Kings Mountain, Little River Canyon, Mammoth Cave, Natchez Trace?, Shiloh); TVA (Tellico); USFS (Bienville?, Chattahoochee, Chattahoochee (Piedmont)?, Chattahoochee (Southern Blue Ridge), Daniel Boone, Holly Springs?, Mark Twain, Oconee?, Ouachita, Ouachita (Coastal Plain), Ouachita (Mountains), Ozark, St. Francis, Sumter (Piedmont)?, Sumter?, Talladega?, Tombigbee?, Tuskegee?)

ELEMENT SOURCES

Buffalo National River Plots: None.
Local Description Authors: M. Pyne
Global Description Authors: A.S. Weakley and K.D. Patterson, mod. R.E. Evans
References: Allard 1990, Burns and Honkala 1990a, Foti 1994b, Foti et al. 1994, NatureServe Ecology - Southeastern U.S. unpubl. data, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data

1.B.2. Cool Temperate Forest

1.B.2.Na. Eastern North American Cool Temperate Forest

M153. Central Mesophytic Hardwood Forest

G020. Appalachian & Interior Mesophytic Forest

Ozark Rich Beech - Mixed Hardwood Forest

***Fagus grandifolia - Quercus rubra - Tilia americana var. caroliniana / Magnolia tripetala / Podophyllum peltatum* Forest**
American Beech - Northern Red Oak - Southern Basswood / Umbrella-tree / Mayapple Forest
Identifier: CEGL007823

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Central Mesophytic Hardwood Forest (M153)
Group	Appalachian & Interior Mesophytic Forest (G020)
Association (Common name)	Ozark Rich Beech - Mixed Hardwood Forest

ELEMENT CONCEPT

Global Summary: This association includes rich forests dominated by *Fagus grandifolia* (American beech) in mixtures with other mesophytic hardwood species, in the Ouachita and Ozark mountains of Arkansas and Oklahoma. This forest is found on sheltered slopes, ravines, and upper terraces, and can be associated with limestone geology. The closed forest canopy is dominated by *Fagus grandifolia* (American beech), usually with codominance by one or more of the following trees: *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Tilia americana var. caroliniana* (Carolina basswood), *Fraxinus americana* (white ash), and *Magnolia acuminata* (cucumber-tree). Other species that may be in the canopy, but not typically with high coverage, include *Acer saccharum* (sugar maple), *Carya alba* (mockernut hickory), *Carya cordiformis* (bitternut hickory), *Carya glabra* (pignut hickory), *Juglans nigra* (black walnut), *Liquidambar styraciflua* (sweetgum), *Nyssa sylvatica* (blackgum), *Quercus velutina* (black oak), and *Ulmus rubra* (slippery elm). *Magnolia tripetala* (umbrella-tree) is often conspicuous in the subcanopy and shrub strata. Other typical subcanopy species are *Ostrya virginiana* (hophornbeam), *Cornus florida* (flowering dogwood), *Carpinus caroliniana* (American hornbeam), *Morus rubra* (red mulberry), and *Hamamelis virginiana* (American witch-hazel). The shrub stratum is open to moderately dense. Typical shrubs and woody vines include *Asimina triloba* (pawpaw), *Lindera benzoin* (northern spicebush), *Dirca palustris* (eastern leatherwood), *Euonymus americanus* (bursting-heart), *Hydrangea arborescens* (wild hydrangea), *Toxicodendron radicans* (eastern poison-ivy), and *Parthenocissus quinquefolia* (Virginia creeper). The herb stratum is lush and diverse, but can very in composition

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from site to site, depending on soil fertility and past disturbance. Some typical species include *Adiantum pedatum* (northern maidenhair), *Actaea pachypoda* (white baneberry), *Amphicarpaea bracteata* (American hogpeanut), *Brachyelytrum erectum* (bearded shorthusk), *Hepatica nobilis var. acuta* (sharplobe hepatica), *Iris cristata* (dwarf crested iris), *Podophyllum peltatum* (mayapple), *Trillium sessile* (toadshade), *Trillium viridescens* (tapertip wakerobin), *Prosartes lanuginosa* (yellow fairybells), *Panax quinquefolius* (American ginseng), and *Polystichum acrostichoides* (Christmas fern).

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This rich beech - mixed hardwood forest was sampled 13 times in the park. Sites include a gently sloping streambed, gently to moderately sloping south- and southwest-facing stream terraces, a moderate northwest-facing hillslope bedrock outcrop, and moderate to steep north-, west- and south-facing mid- and toeslopes. Soils are generally mesic and range from rapidly drained clay loam, loam and sandy loam to well-drained sandy loam and sand to moderately well-drained sandy loam, loam and silt loam. The unvegetated surface is made up of leaf litter (11-99% cover), with some bedrock (0-2%), large rocks (0-60%), small rocks (0-20%), wood (0-2%) standing water (0-5%), and bare soil (0-13%). Evidence of disturbance includes roads and trails, past fire, rain-caused flooding and erosion, and the presence of exotic plants.

Global Environment: This forest is found on sheltered slopes, ravines, and upper terraces, and can be associated with limestone geology. It is an upland forest however, in situations where this forest extends downslope onto cobble bars and streamside terraces, it may be compositionally similar to *Liquidambar styraciflua - (Quercus alba*, *Acer saccharum) / Carpinus caroliniana / Lindera benzoin* Forest (CEGL007826), a temporarily flooded association.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The sparse to completely closed (40-100% cover) tree canopy, 15-35 m tall, is dominated by *Fagus grandifolia* (American beech), *Liquidambar styraciflua* (sweetgum), and *Magnolia acuminata* (cucumber-tree) and may include lesser amounts of *Nyssa sylvatica* (blackgum), *Platanus occidentalis* (American sycamore), *Quercus alba* (white oak), *Quercus muehlenbergii* (chinkapin oak), and *Quercus rubra* (northern red oak), among others. The sparse to very dense (30-90%) subcanopy (5-20 m) is dominated by the same tree dominants along with *Acer saccharum* (sugar maple), *Carya ovata* (shagbark hickory), and *Quercus* (oak) spp. The very sparse to moderate (5-50%) tall-shrub layer (1-10 m) and short-shrub layer (0.5-2 m) are made up of tree saplings as well as *Asimina triloba* (pawpaw), *Carpinus caroliniana* (American hornbeam), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Frangula caroliniana* (Carolina buckthorn), *Fraxinus americana* (white ash), *Hamamelis virginiana* (American witch-hazel), *Hydrangea arborescens* (wild hydrangea), *Lindera benzoin* (northern spicebush), *Magnolia tripetala* (umbrella-tree), *Morus rubra* (red mulberry), *Nyssa sylvatica* (blackgum), *Ostrya virginiana* (hophornbeam), *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), *Sideroxylon lanuginosum* (gum bully), *Staphylea trifolia* (American bladdernut), *Symphoricarpos orbiculatus* (coralberry), *Ulmus alata* (winged elm), *Ulmus rubra* (slippery elm), and *Viburnum rufidulum* (rusty blackhaw). Common species in the very sparse to moderately dense (10-70%) herbaceous layer include *Agrimonia rostellata* (beaked agrimony), *Amphicarpaea bracteata* (American hogpeanut), *Arisaema triphyllum* (Jack in the pulpit), *Aristolochia serpentaria* (Virginia snakeroot), *Brachyelytrum erectum* (bearded shorthusk), *Carex* (sedge) spp., *Circaea lutetiana ssp. canadensis* (broadleaf enchanter's nightshade), *Desmodium* (ticktrefoil) spp., *Dichanthelium boscii* (Bosc's panicgrass), *Dioscorea villosa* (wild yam), *Galium* (bedstraw) spp., *Parthenocissus quinquefolia* (Virginia creeper), *Phlox divaricata ssp. laphamii* (Lapham's phlox), *Phryma leptostachya* (American lopseed), *Podophyllum peltatum* (mayapple), *Prenanthes altissima* (tall rattlesnakeroot), *Sanicula canadensis* (Canadian blacksnakeroot), *Scutellaria elliptica* (hairy skullcap), *Smilax* (greenbrier) spp., *Solidago caesia* (wreath goldenrod), *Thalictrum thalictroides* (rue-anemone), *Toxicodendron radicans* (eastern poison-ivy), *Uvularia grandiflora* (largeflower bellwort), *Viola* (violet) spp., and *Vitis* (grape) spp.; common ferns include *Adiantum pedatum* (northern maidenhair), *Botrychium virginianum* (rattlesnake fern), *Phegopteris hexagonoptera* (broad beechfern), and *Polystichum acrostichoides* (Christmas fern). This community also supports state-critically imperiled *Carex willdenowii* (Willdenow's sedge), state-imperiled *Caulophyllum thalictroides* (blue cohosh), and globally and state-vulnerable *Heuchera villosa var. arkansana* (Arkansas alumroot).

Global Vegetation: The closed forest canopy is dominated by *Fagus grandifolia* (American beech), usually with codominance by one or more of the following trees: *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Tilia americana var. caroliniana* (Carolina basswood), *Fraxinus americana* (white ash), and *Magnolia acuminata* (cucumber-tree). Other species that may be in the canopy, but not typically with high coverage, include *Acer saccharum* (sugar maple), *Carya alba* (mockernut hickory), *Carya cordiformis* (bitternut hickory), *Carya glabra* (pignut hickory), *Juglans nigra* (black walnut), *Liquidambar styraciflua* (sweetgum), *Nyssa sylvatica* (blackgum), *Quercus velutina* (black oak), and *Ulmus rubra* (slippery elm). *Magnolia tripetala* (umbrella-tree) is often conspicuous in the subcanopy and shrub strata. Other typical subcanopy species are *Ostrya virginiana* (hophornbeam), *Cornus florida* (flowering dogwood), *Carpinus caroliniana* (American hornbeam), *Morus rubra* (red mulberry), and *Hamamelis virginiana* (American witch-hazel). The shrub stratum is open to moderately dense. Typical shrubs and woody vines include *Asimina triloba* (pawpaw), *Lindera benzoin* (northern spicebush), *Dirca palustris* (eastern leatherwood), *Euonymus americanus* (bursting-heart), *Hydrangea arborescens* (wild hydrangea), *Toxicodendron radicans* (eastern poison-ivy), and *Parthenocissus quinquefolia* (Virginia creeper). The herb stratum is lush and diverse, but can very in composition from site to site, depending on soil fertility and past disturbance. Some typical species include *Adiantum pedatum* (northern maidenhair), *Actaea pachypoda* (white baneberry), *Amphicarpaea bracteata* (American hogpeanut), *Brachyelytrum erectum* (bearded shorthusk), *Hepatica nobilis var. acuta* (sharplobe hepatica), *Iris cristata* (dwarf crested iris), *Podophyllum peltatum* (mayapple), *Trillium sessile* (toadshade), *Trillium viridescens* (tapertip wakerobin), *Prosartes lanuginosa* (yellow fairybells), *Panax quinquefolius* (American ginseng), and *Polystichum acrostichoides* (Christmas fern).

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MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Fagus grandifolia* (American beech), *Magnolia acuminata* (cucumber-tree)
Tree canopy	Broad-leaved deciduous tree	*Liquidambar styraciflua* (sweetgum)
Tree subcanopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Fagus grandifolia* (American beech), *Magnolia tripetala* (umbrella-tree)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer saccharum* (sugar maple), *Cornus florida* (flowering dogwood)
Short shrub/sapling	Broad-leaved deciduous shrub	*Staphylea trifolia* (American bladdernut)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper)
Herb (field)	Forb	*Amphicarpaea bracteata* (American hogpeanut), *Toxicodendron radicans* (eastern poison-ivy)

CHARACTERISTIC SPECIES

Buffalo National River: *Acer saccharum* (sugar maple), *Amphicarpaea bracteata* (American hogpeanut), *Asimina triloba* (pawpaw), *Carpinus caroliniana* (American hornbeam), *Cornus florida* (flowering dogwood), *Fagus grandifolia* (American beech), *Hydrangea arborescens* (wild hydrangea), *Lindera benzoin* (northern spicebush), *Liquidambar styraciflua* (sweetgum), *Magnolia acuminata* (cucumber-tree), *Magnolia tripetala* (umbrella-tree), *Parthenocissus quinquefolia* (Virginia creeper), *Phegopteris hexagonoptera* (broad beechfern), *Polystichum acrostichoides* (Christmas fern), *Staphylea trifolia* (American bladdernut), *Toxicodendron radicans* (eastern poison-ivy)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Carex willdenowii* (Willdenow's sedge, state-critically imperiled, G5), *Caulophyllum thalictroides* (blue cohosh, state-imperiled, G4G5), *Heuchera villosa* var. *arkansana* (Arkansas alumroot, globally and state-vulnerable, G5T3Q), *Viburnum molle* (softleaf arrowwood, state-critically imperiled, G5); **Exotic/Invasive**: *Allium vineale* (wild garlic, exotic, Medium/Insignificant), *Dianthus armeria* (Deptford pink, exotic, Low/Insignificant), *Lonicera japonica* (Japanese honeysuckle, exotic, High/Medium), *Perilla frutescens* (beefsteakplant, exotic, Low), *Rosa multiflora* (multiflora rose, exotic, Medium/Low), *Taraxacum officinale* (common dandelion, exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (11-Dec-1998). This association occurs on portions of the landscape where periodic fires were not frequent, and it could have been present on mesic middle and lower slopes throughout much of the Ozark-Ouachita region. Except for examples on U.S. Forest Service lands, intact occurrences of this association have become increasingly rare. During the early part of the 20th century, much of the landscape within its range was logged or converted to agricultural cropland. In addition, many of these highly productive sites have been converted to commercial pine plantations, eliminating the original hardwood-dominated community altogether. Current threats include increased erosion, windthrow, microclimate modification from intensive silvicultural practices on adjacent uplands, forest type conversion, herbicide use, and vegetation damage by feral hogs.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: This association has been described as an "unique Ozarkian assemblage" distinct from mixed mesophytic forests of the eastern United States and the Beech-Maple forests of the midwestern United States (USFS 1990). This association is known from Ozark and Ouachita national forests RNAs (Roaring Branch and Dismal Hollow). The Dismal Hollow occurrence (Newton County, Arkansas) is a particularly rich and exemplary example. The occurrence of this association in Oklahoma is restricted to La Flore and McCurtain counties. The composition of these forests suggest that they do not extend into the Missouri Ozarks and that they warrant a specific association.

In situations where this forest extends downslope onto cobble bars and streamside terraces, it may be compositionally similar to *Liquidambar styraciflua - (Quercus alba*, *Acer saccharum) / Carpinus caroliniana / Lindera benzoin* Forest (CEGL007826). *Fagus grandifolia - Acer saccharum - Liriodendron tulipifera* Unglaciated Forest (CEGL002411) is somewhat compositionally similar to this association, but much more broadly defined and dominated by *Acer saccharum* (sugar maple), which is absent to insignificant in this association. *Fagus grandifolia - Quercus alba / Ilex opaca var. opaca / Athyrium filix-femina ssp. asplenioides* Forest (CEGL007208) is a similar association defined for in the West Gulf Coastal of the southeastern United States. Two other rich forest types in the Arkansas Ozarks are *Acer (barbatum*, *saccharum) - Juglans nigra - Fraxinus americana / Hybanthus concolor* Forest (CEGL007811) and *Quercus alba - Quercus rubra - Acer saccharum - Carya cordiformis / Lindera benzoin* Forest (CEGL002058). These forests lack dominance by *Fagus grandifolia* (American beech) and may be more calcareous than the association defined here.
Global Similar Associations:
Acer (barbatum, saccharum) - Juglans nigra - Fraxinus americana / Hybanthus concolor Forest (CEGL007811)

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Fagus grandifolia - Acer saccharum - Liriodendron tulipifera Unglaciated Forest (CEGL002411)
Fagus grandifolia - Quercus alba / Ilex opaca var. opaca / Athyrium filix-femina ssp. asplenioides Forest (CEGL007208)
Liquidambar styraciflua - (Quercus alba, Acer saccharum) / Carpinus caroliniana / Lindera benzoin Forest (CEGL007826)
Quercus alba - Quercus rubra - Acer saccharum - Carya cordiformis / Lindera benzoin Forest (CEGL002058)

Global Related Concepts:

Fagus grandifolia - Nyssa sylvatica / Ostrya virginiana - Hamamelis virginiana / Parthenocissus quinquefolia / Carex spp. - *Actaea alba* Ravine Bottom Forest (Smith et al. 2000) **?**
Beech Type (BE) (Dale and Kuroda 1979) **?**
T1B4aI. *Fagus grandifolia* (Foti et al. 1994) **?**
T1B4aI1a. *Fagus grandifolia / Magnolia tripetala* (Foti et al. 1994) **?**
T1B4aI1b. *Fagus grandifolia - Acer saccharum - Quercus* spp. (*alba, muehlenbergii, rubra*) (Foti et al. 1994) **?**

ELEMENT DISTRIBUTION

Buffalo National River Range: This rich beech - mixed hardwood forest was sampled near the Whiteley School, and along the Buffalo River Trail, Boxley Trail, and the Lost Valley Trail. It is more common in the upper Buffalo, and rare or absent below the confluence of the Buffalo and Little Buffalo, and sparse below Erbie.
Global Range: This community is found in the Ouachita and Ozark mountains of Arkansas and Oklahoma.
Nations: US
States/Provinces: AR, OK
TNC Ecoregions: 38:C, 39:C
USFS Ecoregions (1994/95): M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC
Federal Lands: NPS (Buffalo River); USFS (Ouachita, Ouachita (Mountains), Ozark)

ELEMENT SOURCES

Buffalo National River Plots: (13 plots): BUFF.003, BUFF.004, BUFF.009, BUFF.024, BUFF.044, BUFF.045, BUFF.046, BUFF.047, BUFF.048, BUFF.049, BUFF.050, BUFF.759, BUFF.799.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: M. Pyne and K.D. Patterson
References: Campbell et al. 1996, Dale and Kuroda 1979, Foti 1994a, Foti et al. 1994, Fountain and Sweeney 1985, Hoagland 1997, Hoagland 2000, NatureServe Ecology - Southeastern U.S. unpubl. data, Smith et al. 2000, Southeastern Ecology Working Group n.d., USFS 1990, Zanoni et al. 1979

White Oak - Red Oak - Sugar Maple Mesic Forest

***Quercus alba - Quercus rubra - Acer saccharum - Carya cordiformis / Lindera benzoin* Forest**
White Oak - Northern Red Oak - Sugar Maple - Bitternut Hickory / Northern Spicebush Forest
Identifier: CEGL002058

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Central Mesophytic Hardwood Forest (M153)
Group	Appalachian & Interior Mesophytic Forest (G020)
Association (Common name)	White Oak - Red Oak - Sugar Maple Mesic Forest

ELEMENT CONCEPT

Global Summary: This mesic white oak - red oak - maple forest type is known from the south-central United States, particularly the Ozark/Ouachita region of Arkansas, Missouri, and eastern Oklahoma. Stands occur on gentle to moderately steep lower slopes in ravines, valleys, bases of bluffs, and sinkhole basins, generally with northern or eastern aspects. The soils are moderately well-drained and shallow to deep. The substrate is various types of bedrock (and colluvium derived from the bedrock), typically limestone or dolomite, but also sandstone or igneous material. The bedrock may be exposed directly or present as residual rock fragments or talus boulders. The canopy is dominated by *Quercus rubra* (northern red oak) with *Quercus alba* (white oak), *Acer saccharum* (sugar maple), *Fraxinus americana* (white ash), and *Tilia americana (var. americana)*, with lesser amounts of *Carya alba* (mockernut hickory), *Carya cordiformis* (bitternut hickory), *Fraxinus americana* (white ash), *Juglans nigra* (black walnut), and *Ulmus rubra* (slippery elm). The understory closure varies with the moisture status of the site, being more closed under greater moisture conditions. Numerous herbs and ferns may be found in examples of this association.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This common white oak - red oak - maple forest was sampled at 27 locations in the park. Sites range from moderate to somewhat steep to steep, mid- to upper slopes, benches, toeslopes, talus slopes and ravines of any aspect. Soils are typically mesic and dry-mesic, rapidly drained to moderately well-drained clay loam, sandy loam, silt loam, and loam. One site has xeric, rapidly drained, rocky sand soil. The unvegetated surface is dominated by leaf litter (43-100% cover), with some bedrock (0-5%), large rocks (0-50%), small rocks (0-3%), wood (0-4%), and bare soil (0-5%). Evidence of disturbance includes past fire and logging, roads and trails, erosion, fire suppression, hydrologic disturbance, wind damage, and the presence of exotic plants.

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Global Environment: Stands occur on gentle to moderately steep lower slopes in ravines, valleys, bases of bluffs, and sinkhole basins, generally with northern or eastern aspects. The soils are moderately well-drained and shallow to deep. The substrate is various types of bedrock (and colluvium derived from the bedrock), typically limestone or dolomite, but also sandstone or igneous material. The bedrock may be exposed directly or as residual rock fragments or talus boulders (Nelson 1985, Campbell et al. 1996).

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The moderately sparse to very dense (40-90% cover) tree canopy, 15-35 m tall, and sparse to very dense (30-90%) subcanopy (10-20 m) are dominated by *Acer saccharum* (sugar maple), *Carya cordiformis* (bitternut hickory), *Carya ovata* (shagbark hickory), *Quercus alba* (white oak), *Quercus muehlenbergii* (chinkapin oak), and *Quercus rubra* (northern red oak) and may include lesser amounts of *Fraxinus americana* (white ash), *Juglans nigra* (black walnut), *Liquidambar styraciflua* (sweetgum), *Magnolia acuminata* (cucumber-tree), *Nyssa sylvatica* (blackgum), *Quercus shumardii* (Shumard oak), and *Tilia americana* (American basswood). The sparse to very dense (30-90%) tall-shrub layer (2-10 m) is dominated by *Acer saccharum* (sugar maple), *Asimina triloba* (pawpaw), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Lindera benzoin* (northern spicebush), *Ostrya virginiana* (hophornbeam), and *Tilia americana* (American basswood). The very sparse to moderately dense (10-70%) short-shrub layer (0.5-2 m) is dominated by *Lindera benzoin* (northern spicebush) and *Ostrya virginiana* (hophornbeam). The very sparse to very dense (10-90%) herbaceous layer may be dominated by *Polymnia canadensis* (whiteflower leafcup), *Parthenocissus quinquefolia* (Virginia creeper), or *Toxicodendron radicans* (eastern poison-ivy) and may include *Amphicarpaea bracteata* (American hogpeanut), *Asarum canadense* (Canadian wildginger), *Actaea racemosa* (black baneberry), and *Polystichum acrostichoides* (Christmas fern). Vines (up to 30% cover) include *Vitis aestivalis* (summer grape) and *Vitis vulpina* (frost grape). This community also supports state-critically imperiled *Carex radiata* (eastern star sedge), globally and state-imperiled *Delphinium newtonianum* (Newton's larkspur), *Tradescantia ozarkana* (Ozark spiderwort), and *Trillium pusillum var. ozarkanum* (Ozark wakerobin).

Global Vegetation: The canopy is dominated by *Quercus rubra* (northern red oak) with *Quercus alba* (white oak), *Acer saccharum* (sugar maple), *Fraxinus americana* (white ash), and *Tilia americana var. americana* (American basswood), with lesser amounts of *Carya alba* (mockernut hickory), *Carya cordiformis* (bitternut hickory), *Fraxinus americana* (white ash), *Juglans nigra* (black walnut), and *Ulmus rubra* (slippery elm). The understory closure varies with the moisture status of the site, being more closed under greater moisture conditions. Other characteristic woody species include *Aesculus glabra* (Ohio buckeye), *Asimina triloba* (pawpaw), *Carya cordiformis* (bitternut hickory), *Carpinus caroliniana* (American hornbeam), *Celtis laevigata* (sugarberry), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Euonymus atropurpureus* (eastern wahoo), *Ilex decidua* (possum-haw), *Juglans cinerea* (butternut), *Magnolia acuminata* (cucumber-tree), *Morus rubra* (red mulberry), *Ostrya virginiana* (hophornbeam), *Prunus serotina* (black cherry), *Quercus muehlenbergii* (chinkapin oak), and *Staphylea trifolia* (American bladdernut). Shrubs and woody vines include *Euonymus americanus* (bursting-heart), *Castanea pumila var. ozarkensis* (Ozark chinkapin), *Frangula caroliniana* (Carolina buckthorn), *Hamamelis virginiana* (American witch-hazel), *Hydrangea arborescens* (wild hydrangea), *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy), and *Viburnum rufidulum* (rusty blackhaw). Characteristic herbs include *Amphicarpaea bracteata* (American hogpeanut), *Aplectrum hyemale* (Adam and Eve), *Aralia racemosa* (American spikenard), *Aristolochia serpentaria* (Virginia snakeroot), *Asarum canadense* (Canadian wildginger), *Brachyelytrum erectum* (bearded shorthusk), *Cardamine concatenata* (cutleaf toothwort), *Carex albursina* (white bear sedge), *Chasmanthium latifolium* (Indian woodoats), *Actaea racemosa* (black baneberry), *Circaea lutetiana ssp. canadensis* (broadleaf enchanter's nightshade), *Collinsonia canadensis* (richweed), *Cynoglossum virginianum* (wild comfrey), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dicentra canadensis* (squirrel corn), *Dicentra cucullaria* (Dutchman's breeches), *Dioscorea quaternata* (fourleaf yam), *Elymus virginicus* (Virginia wildrye), *Erigenia bulbosa* (harbinger of spring), *Erythronium rostratum* (yellow troutlily), *Hepatica nobilis var. obtusa* (roundlobe hepatica), *Hybanthus concolor* (eastern greenviolet), *Hydrastis canadensis* (goldenseal), *Hydrophyllum* (waterleaf) spp., *Iris cristata* (dwarf crested iris), *Panax quinquefolius* (American ginseng), *Phryma leptostachya* (American lopseed), *Podophyllum peltatum* (mayapple), *Polygonum virginianum* (jumpseed), *Sanguinaria canadensis* (bloodroot), *Silene ovata* (Blue Ridge catchfly), *Solidago flexicaulis* (zigzag goldenrod), *Stylophorum diphyllum* (celandine poppy), *Uvularia grandiflora* (largeflower bellwort), and *Melanthium woodii* (Wood's bunchflower). Numerous ferns may be found in examples of this association, including *Adiantum pedatum* (northern maidenhair), *Asplenium platyneuron* (ebony spleenwort), *Cystopteris protrusa* (lowland bladderfern), *Dennstaedtia punctilobula* (eastern hayscented fern), *Deparia acrostichoides* (silver false spleenwort), *Diplazium pycnocarpon* (glade fern), *Phegopteris hexagonoptera* (broad beechfern), and *Polystichum acrostichoides* (Christmas fern) (Nelson 1985, Campbell et al. 1996, Hoagland 1997).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple), *Quercus alba* (white oak), *Quercus rubra* (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	*Carya cordiformis* (bitternut hickory), *Fraxinus americana* (white ash), *Magnolia acuminata* (cucumber-tree), *Quercus muehlenbergii* (chinkapin oak)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Lindera benzoin* (northern spicebush), *Ostrya virginiana* (hophornbeam)

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Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer saccharum* (sugar maple), *Cornus florida* (flowering dogwood)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper), *Vitis vulpina* (frost grape)
Herb (field)	Forb	*Polymnia canadensis* (whiteflower leafcup), *Toxicodendron radicans* (eastern poison-ivy)
Herb (field)	Fern or fern ally	*Polystichum acrostichoides* (Christmas fern)

Global

Stratum	**Lifeform**	**Species**
Tree canopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple), *Fraxinus americana* (white ash), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Tilia americana* var. *americana* (American basswood)

CHARACTERISTIC SPECIES

Buffalo National River: *Acer saccharum* (sugar maple), *Actaea racemosa* (black baneberry), *Adiantum pedatum* (northern maidenhair), *Amphicarpaea bracteata* (American hogpeanut), *Carya cordiformis* (bitternut hickory), *Cornus florida* (flowering dogwood), *Fraxinus americana* (white ash), *Lindera benzoin* (northern spicebush), *Magnolia acuminata* (cucumber-tree), *Ostrya virginiana* (hophornbeam), *Parthenocissus quinquefolia* (Virginia creeper), *Polymnia canadensis* (whiteflower leafcup), *Polystichum acrostichoides* (Christmas fern), *Quercus alba* (white oak), *Quercus muehlenbergii* (chinkapin oak), *Quercus rubra* (northern red oak), *Toxicodendron radicans* (eastern poison-ivy), *Vitis aestivalis* (summer grape), *Vitis vulpina* (frost grape)
Global: *Acer saccharum* (sugar maple), *Carya cordiformis* (bitternut hickory), *Fraxinus americana* (white ash), *Quercus alba* (white oak), *Quercus rubra* (northern red oak)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Carex hirtifolia* (pubescent sedge, state-vulnerable, G5), *Carex radiata* (eastern star sedge, state-critically imperiled, G4), *Delphinium newtonianum* (Newton's larkspur, globally and state-vulnerable, G3), *Tradescantia ozarkana* (Ozark spiderwort, globally and state-vulnerable, G3), *Trillium pusillum* var. *ozarkanum* (Ozark wakerobin, globally and state-vulnerable, G3T3); **Exotic/Invasive**: *Alliaria petiolata* (garlic mustard, exotic, High/Medium), *Lonicera japonica* (Japanese honeysuckle, exotic, High/Medium), *Rubus phoenicolasius* (wine raspberry, exotic, Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3? (24-Oct-2002). This community has a moderately restricted range, found primarily in the western portions of the Interior Highlands of the south-central United States. Site factors are not particularly specific, but it may require a combination of thin soils, occasional ground fires, and infrequent catastrophic fires to persist. Extensive clearing and use of oaks for lumber have contributed to the large decline in this forest type. Remaining parcels of this type are subject to timber harvesting, but conversion to non-forest is less likely. There are few areas where old forest (100- to 150-year-old stands) or old-growth forest (>150 years) conditions are present. Many stands have also been grazed in the past, resulting in ground and shrub layers that are simplified or prone to invasion by exotics. Stands may require low-intensity surface fires to maintain the quality of the ground layer, and these are often lacking.

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Global Comments: This type fits in with a moist oak - maple group, and many sites may succeed to more sugar maple-dominated stands. In Arkansas, this vegetation is closely related to *Acer (saccharum*, *barbatum) - Quercus rubra - Carya cordiformis / Asimina triloba* Forest (CEGL002060). Douglas Zollner (pers. comm. 1998) suggests that fire frequency may account for the differences, since *Acer saccharum* (sugar maple) is more susceptible to fire. Mike Homoya (pers. comm. 1996) thought this type could be in Indiana as described. This type is described by Hoagland (1997) as occurring on mesic slopes and floodplains in the easternmost tier of Oklahoma counties (Adair, Cherokee, Delaware, LeFlore, Mayes, McCurtain, Muskogee, Ottawa, and Sequoyah). Missouri's Mesic Igneous Forest (Nelson 1985) is a poorly understood variant that needs further study.
Global Similar Associations:
Acer (barbatum, saccharum) - Juglans nigra - Fraxinus americana / Hybanthus concolor Forest (CEGL007811)
Acer (saccharum, barbatum) - Quercus rubra - Carya cordiformis / Asimina triloba Forest (CEGL002060)
Fagus grandifolia - Quercus rubra - Tilia americana var. caroliniana / Magnolia tripetala / Podophyllum peltatum Forest (CEGL007823)
Quercus alba - Quercus rubra - Acer saccharum Sand Forest (CEGL005187)
Quercus alba - Quercus rubra - Carya (alba, ovata) / Cornus florida Acidic Forest (CEGL002067)
Quercus rubra - Acer saccharum - Tilia americana var. heterophylla - Aesculus flava - (Cladrastis kentukea) Forest (CEGL007698)
Global Related Concepts:
Mesic Forest (Nelson 1985) ><
Mesic Forest, Mesic Limestone/Dolomite Forest, Mesic Igneous Forest, Mesic Sandstone Forest (Nelson 1985) **?**

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Mesic Igneous Forest (Nelson 1985) ><
Mesic Sandstone Forest (Nelson 1985) ><
Mesic oak - hickory community (Tucker 1989) **?**
T1B4aII3a. *Acer saccharum* - *Quercus* spp. (*alba, rubra*) - *Carya* spp. (*ovata, tomentosa, cordiformis*) (Foti et al. 1994) **?**

ELEMENT DISTRIBUTION

Buffalo National River Range: This white oak - red oak - maple forest was sampled along Buffalo River Trail, Chimney Rock Trail, Indian Rockhouse Trail, and Over the Mountain Trail, and near Tilting Rock, McCutchen Gap, Tyler Bend, Arudd Bluff, Cecil Cove, and Kilgore Mountain.
Global Range: This mesic white oak - red oak - maple forest type is known from the south-central United States, particularly the Ozark and Ouachita regions of Arkansas, Missouri, and eastern Oklahoma.
Nations: US
States/Provinces: AR, MO, OK
TNC Ecoregions: 36:C, 38:C, 39:C
USFS Ecoregions (1994/95): 222Ac:CCC, 222Ad:CC?, 222Ae:CC?, 222Ag:CCC, 222Aj:CCP, 222Ak:CCC, 222Am:CC?, 222An:CCC, 222Ao:CCC, 222Ap:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 231:C, 251Cb:CCC, 251Cc:CCC, 251Cd:CC?, 251Ce:CCC, 251Cg:CCC, M222Aa:CCC, M222Ab:CCC
Federal Lands: NPS (Buffalo River, Ozark Riverways); USFS (Ouachita, Ouachita (Mountains), Ozark)

ELEMENT SOURCES

Buffalo National River Plots: (27 plots): BUFF.006, BUFF.031, BUFF.032, BUFF.040, BUFF.051, BUFF.055, BUFF.056, BUFF.057, BUFF.058, BUFF.059, BUFF.060, BUFF.064, BUFF.065, BUFF.095, BUFF.129, BUFF.148, BUFF.174, BUFF.197, BUFF.198, BUFF.703, BUFF.704, BUFF.726, BUFF.742, BUFF.753, BUFF.760, BUFF.761, BUFF.763.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: D. Faber-Langendoen
References: Blair 1938, Campbell et al. 1996, Chastain et al. 2006, Foti et al. 1994, Hoagland 1997, Hoagland 2000, Homoya pers. comm., Midwestern Ecology Working Group n.d., NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1985, Nigh et al. 2000, Parker 1989, Tucker 1989, Zollner pers. comm.

M012. Central Oak-Hardwood & Pine Forest

G158. Northeastern & North-Central Oak - Hickory Forest

Black Oak - White Oak - Hickory Forest

***Quercus velutina - Quercus alba - Carya (glabra, ovata)* Forest**
Black Oak - White Oak - (Pignut Hickory, Shagbark Hickory) Forest
Identifier: CEGL002076

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Central Oak-Hardwood & Pine Forest (M012)
Group	Northeastern & North-Central Oak - Hickory Forest (G158)
Association (Common name)	Black Oak - White Oak - Hickory Forest

ELEMENT CONCEPT

Global Summary: This black oak - white oak forest community is found throughout the northern and central midwestern United States and adjacent Canada. Stands occur on dry to dry-mesic mid- to upper slopes and terraces where soils are more sandy and/or rocky. Bedrock is sandstone, siltstone, chert, or shale, and northward is covered by thin loess or glacial till. Trees in this community often have moderate to short trunks and spreading crowns, and the canopy can vary from open to closed (50-100%). *Quercus velutina* (black oak), *Quercus alba* (white oak), *Carya glabra* (pignut hickory), and *Carya ovata* (shagbark hickory) are typical tree dominants. Associated oaks can include *Quercus ellipsoidalis* (northern pin oak) (northward), *Quercus muehlenbergii* (chinkapin oak), and southward, *Quercus coccinea* (scarlet oak), *Quercus prinus* (chestnut oak), and *Quercus stellata* (post oak). Typical shrubs and small trees include *Cornus florida* (flowering dogwood) (southward), *Cornus foemina* (stiff dogwood), *Corylus americana* (American hazelnut) (northward), *Ostrya virginiana* (hophornbeam), and *Sassafras albidum* (sassafras). Vines include *Toxicodendron radicans* (eastern poison-ivy), *Parthenocissus quinquefolia* (Virginia creeper), and *Vitis* (grape) spp. The herbaceous layer can include *Agrimonia gryposepala* (tall hairy agrimony), *Agrimonia rostellata* (beaked agrimony), *Amphicarpaea bracteata* (American hogpeanut), *Botrychium virginianum* (rattlesnake fern), *Carex blanda* (eastern woodland sedge), *Carex pensylvanica* (Pennsylvania sedge), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dioscorea quaternata* (fourleaf yam), *Galium circaezans* (licorice bedstraw), *Geranium maculatum* (spotted geranium), *Polystichum acrostichoides* (Christmas fern), *Maianthemum racemosum* (feathery false lily of the valley), and *Maianthemum stellatum* (starry false lily of the valley), among others. More southern stands may contain *Danthonia spicata* (poverty oatgrass).

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ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This black oak - white oak forest was sampled at 13 locations in the park. Sites range from gentle to somewhat steep, mid- to upper slopes and ridges with mostly northern aspects. Soils are moderately well- to well-drained clay loam, sandy loam, silt loam and loam. The unvegetated surface is dominated by leaf litter (75-99% cover), with some bedrock (0-5%), large rocks (0-3%), small rocks (0-7%), wood (0-15%), and bare soil (0-15%). Evidence of disturbance includes roads and trails and recent fire.

Global Environment: This community is often found on ridge crests or upper slopes that are well-drained to excessively drained. Soils are often sandy loam, thin and rocky, with outcroppings of exposed bedrock. Bedrock is sandstone, siltstone, chert, or shale, or northward covered by thin loess or glacial till (Curtis 1959, White and Madany 1978, Nelson 1985).

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The sparse to dense (30-80% cover) tree canopy, 15-35 m tall, is dominated by *Quercus alba* (white oak) and *Quercus velutina* (black oak); additional species may include *Carya texana* (black hickory) and *Quercus falcata* (southern red oak). The sparse to dense (30-80%) subcanopy (10-20 m) is made up of canopy species as well as *Carya alba* (mockernut hickory), *Cornus florida* (flowering dogwood), and *Nyssa sylvatica* (blackgum). The very sparse to dense (10-80%) tall-shrub layer (2-5 m) is dominated by *Cornus florida* (flowering dogwood), as is the very sparse to dense (5-80%) short-shrub layer (0.5-1 m); additional species may include saplings of tree species as well as *Amelanchier arborea* (common serviceberry) and *Viburnum rufidulum* (rusty blackhaw). The very sparse to closed (10-100%) herbaceous layer includes *Amphicarpaea bracteata* (American hogpeanut), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Orbexilum pedunculatum* (Sampson's snakeroot), and *Toxicodendron pubescens* (Atlantic poison-oak) Vines (5%) include *Vitis aestivalis* (summer grape). This community also supports the state-imperiled *Carex mesochorea* (midland sedge).

Global Vegetation: Trees in this community often have moderate to short trunks and spreading crowns, and the canopy can vary from open to closed (50-100%). *Quercus velutina* (black oak), *Quercus alba* (white oak), *Carya glabra* (pignut hickory), and *Carya ovata* (shagbark hickory) are typical tree dominants. Associated oaks can include *Quercus ellipsoidalis* (northern pin oak) (northward), *Quercus muehlenbergii* (chinkapin oak), and southward, *Quercus coccinea* (scarlet oak), *Quercus prinus* (chestnut oak) and *Quercus stellata* (post oak). Typical shrubs and small trees include *Cornus florida* (flowering dogwood) (southward), *Cornus foemina* (stiff dogwood), *Corylus americana* (American hazelnut) (northward), *Ostrya virginiana* (hophornbeam), and *Sassafras albidum* (sassafras). Vines include *Toxicodendron radicans* (eastern poison-ivy), *Parthenocissus quinquefolia* (Virginia creeper), and *Vitis* (grape) spp. The herbaceous layer can include *Agrimonia gryposepala* (tall hairy agrimony), *Agrimonia rostellata* (beaked agrimony), *Amphicarpaea bracteata* (American hogpeanut), *Botrychium virginianum* (rattlesnake fern), *Carex blanda* (eastern woodland sedge), *Carex pensylvanica* (Pennsylvania sedge), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dioscorea quaternata* (fourleaf yam), *Galium circaezans* (licorice bedstraw), *Geranium maculatum* (spotted geranium), *Polystichum acrostichoides* (Christmas fern), *Maianthemum racemosum* (feathery false lily of the valley), and *Maianthemum stellatum* (starry false lily of the valley), among others (Curtis 1959, White and Madany 1978, Nelson 1985, TNC 1995a). *Quercus velutina* (black oak) does not persist under a dense overstory and is most abundant in cut-over upland forests where the canopy is incomplete.

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Quercus alba* (white oak), *Quercus velutina* (black oak)
Tree subcanopy	Broad-leaved deciduous tree	*Carya alba* (mockernut hickory)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Cornus florida* (flowering dogwood)
Herb (field)	Forb	*Amphicarpaea bracteata* (American hogpeanut), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Toxicodendron radicans* (eastern poison-ivy)

Global

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Carya ovalis* (red hickory), *Carya ovata* (shagbark hickory), *Quercus alba* (white oak), *Quercus velutina* (black oak)
Tree subcanopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple), *Sassafras albidum* (sassafras)
Shrub/sapling (tall & short)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy), *Vitis vulpina* (frost grape)
Tall shrub/sapling	Broad-leaved deciduous tree	*Cornus florida* (flowering dogwood), *Cornus foemina* (stiff dogwood)
Herb (field)	Forb	*Agrimonia rostellata* (beaked agrimony), *Amphicarpaea bracteata* (American hogpeanut), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dioscorea quaternata* (fourleaf yam), *Galium circaezans* (licorice bedstraw), *Maianthemum racemosum*

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		(feathery false lily of the valley), *Maianthemum stellatum* (starry false lily of the valley)
Herb (field)	Graminoid	*Carex blanda* (eastern woodland sedge)
Herb (field)	Fern or fern ally	*Botrychium virginianum* (rattlesnake fern), *Polystichum acrostichoides* (Christmas fern)

CHARACTERISTIC SPECIES

Buffalo National River: *Amphicarpaea bracteata* (American hogpeanut), *Carya alba* (mockernut hickory), *Cornus florida* (flowering dogwood), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Quercus alba* (white oak), *Quercus velutina* (black oak), *Toxicodendron radicans* (eastern poison-ivy)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Carex mesochorea* (midland sedge, state-imperiled, G4G5)
Global: Vulnerable: *Myotis sodalis* (indiana myotis, State listed endangered; often utilize shagbark hickory as roost sites (TNC 1995a), G2); **Other**: *Agkistrodon contortrix* (copperhead, G5), *Callirhytis quercuspunctata* (gouty oak gall wasp, GNR), *Caprimulgus vociferus* (whip-poor-will, G5), *Chionaspis corni* (dogwood scale, GNR), *Cyanocitta cristata* (blue jay, G5), *Dendroica cerulea* (cerulean warbler, G4), *Dryocopus pileatus* (pileated woodpecker, G5), *Eurytides marcellus* (zebra swallowtail, G5), *Glaucomys volans* (southern flying squirrel, G5), *Hylocichla mustelina* (wood thrush, G5), *Lynx rufus* (bobcat, State listed threatened in Illinois (TNC 1995a), G5), *Melanerpes carolinus* (red-bellied woodpecker, G5), *Melanerpes erythrocephalus* (red-headed woodpecker, G5), *Meleagris gallopavo* (wild turkey, G5), *Nymphalis antiopa* (mourning cloak, G5), *Odocoileus virginianus* (white-tailed deer, G5), *Piranga olivacea* (scarlet tanager, G5), *Plestiodon laticeps* (broad-headed skink, G5), *Sayornis phoebe* (eastern phoebe, G5), *Schizura badia* (chestnut schizura, G5), *Sciurus carolinensis* (eastern gray squirrel, G5), *Sciurus niger* (eastern fox squirrel, G5), *Tamias striatus* (eastern chipmunk, G5), *Thryothorus ludovicianus* (carolina wren, G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (3-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: It is possible that unglaciated stands may differ sufficiently from glaciated stands to warrant separating into two types, but this depends on resolving the types' distribution southward. Is there a thin acidic soil, non-glaciated type (i.e., *Quercus alba - Carya alba - (Quercus velutina) / Desmodium nudiflorum - (Carex picta)* Forest (CEGL007795)) versus deeper, glacial soil type? This type appears to go as far north as northern Illinois, Indiana, and southern Michigan, and probably into southern Wisconsin in section 222K, but not 222L (Eric Epstein pers. comm. 1999, H. Dunevitz pers. comm. 2000). The type concept in Wisconsin remains to be resolved. Indiana suggested that the unglaciated stands have more *Quercus coccinea* (scarlet oak). In Michigan, this could fit the interlobate region. Types on sand and typically more dominated by *Quercus velutina* (black oak) are placed in either *Quercus velutina - Quercus alba / Vaccinium (angustifolium, pallidum) / Carex pensylvanica* Forest (CEGL005030) or *Quercus velutina / Carex pensylvanica* Forest (CEGL002078). This type has been described in southern Illinois by Robertson et al. (1984), Fralish (1988b), and Fralish et al. (1991). Braun (1950, p. 145-146) also noted the prominence of black and white oaks in the Ozark Hills and Illinois, the Mammoth Cave area of Kentucky, and throughout the oak-hickory forest region, especially the Mississippi Valley and Prairie Peninsula regions. In Minnesota, the Bigwoods Southeast section may not contain consistent enough black oak to fit this type, but northern pin oak may be common. In the Ozarks, this type may exist, but, based on the recommendations from D. Ladd, T. Nigh, D. Zollner, and B. Heumann, stands are placed either in *Quercus alba - Quercus stellata - Quercus velutina / Schizachyrium scoparium* Woodland (CEGL002150) or in *Quercus velutina - Quercus coccinea - Carya texana* Ozark Forest (CEGL002399). *Quercus alba - (Quercus velutina) - Carya ovata / Ostrya virginiana* Forest (CEGL002011) may be equivalent to this type, at least in northern Missouri (M. Leahy pers. comm. 1999).
Global Similar Associations:
Quercus (alba, rubra, velutina) / Cornus florida / Viburnum acerifolium Forest (CEGL006336)
Quercus alba - (Quercus velutina) - Carya ovata / Ostrya virginiana Forest (CEGL002011) This more western oak-hickory type is at or near the range limits of white, black and red oak, and only shagbark hickory is present.
Quercus alba - Carya alba - (Quercus velutina) / Desmodium nudiflorum - (Carex picta) Forest (CEGL007795)
Quercus alba - Carya alba / Ostrya virginiana / Carex pensylvanica - Schizachyrium scoparium Forest (CEGL007818)
Quercus alba - Quercus rubra - Carya (alba, ovata) / Cornus florida Acidic Forest (CEGL002067) can also be found under environmental conditions which support this community.
Quercus alba - Quercus rubra - Quercus muehlenbergii / Cercis canadensis Forest (CEGL002070)
Quercus alba - Quercus stellata - Quercus velutina / Schizachyrium scoparium Woodland (CEGL002150)
Quercus alba - Quercus velutina - Carya alba / Desmodium nudiflorum Ozark Forest (CEGL004270)
Quercus falcata - Quercus alba - Quercus stellata - Quercus velutina Forest (CEGL005018) is restricted to sandy loam soils in the Interior Low Plateau and Appalachian Plateau.
Quercus rubra - Quercus alba - (Quercus velutina, Acer rubrum) / Viburnum acerifolium Forest (CEGL002462)
Quercus velutina - Carya (alba, glabra) / Vaccinium arboreum Forest (CEGL004987)

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Quercus velutina - Quercus alba / Vaccinium (angustifolium, pallidum) / Carex pensylvanica Forest (CEGL005030) is typically on deep sandy substrates.
Quercus velutina - Quercus coccinea - Carya texana Ozark Forest (CEGL002399)
Quercus velutina / Carex pensylvanica Forest (CEGL002078) found on deeper sands, more mono-dominant.

Global Related Concepts:
Quercus velutina - Quercus alba upper slope community type (Robertson et al. 1984) =
Black Oak: 110 (Eyre 1980) >
Dry Chert Forest (Nelson 1985) ><
Dry Forest (Nelson 1985) ><
Dry Forest, Dry Acid (Chert, Igneous, Sandstone) Forest (Nelson 1985) **?**
Dry Igneous Forest (Nelson 1985) ><
Dry Sandstone Forest (Nelson 1985) ><
Dry Southern Forest - Black Oak-White Oak (Chapman et al. 1989) >
Eastern Broadleaf Forests: 100: Oak-Hickory Forest (*Quercus-Carya*) (Kuchler 1964) >
Oak-Hickory Forests (Anderson 1996) >
Southern Dry Forest (Curtis 1959) =
T1B4aII4c. *Quercus alba - Quercus velutina - Quercus falcata* (Foti et al. 1994) **?**
Terrestrial: Forest: Hardwood (TNC 1985) >
UNESCO FORMATION CODE: I.B.3a (UNESCO 1973) >
White Oak - Black Oak - Northern Red Oak: 52 (Eyre 1980) >
White Oak-Black Oak-Hickory Association (Gordon 1969) =
White Oak: 53 (Eyre 1980) >

ELEMENT DISTRIBUTION

Buffalo National River Range: This association was sampled along Buffalo River Trail, near Kimball Bluff, Buffalo Point, and Collier Homestead Historic Site, and at Lower Buffalo Wilderness at Turkey Mountain and Seven-mile Bend.
Global Range: This oak forest community is found throughout the northern and central midwestern United States and adjacent Canada, ranging from Ohio and Ontario, west to possibly southern Wisconsin, south to northern Missouri, and east to Indiana and Kentucky.
Nations: CA, US
States/Provinces: AR, IA?, IL, IN, KY, MI, MN, MO, OH, ON
TNC Ecoregions: 36:C, 38:C, 44:C, 46:C, 47:C, 48:C, 49:C
USFS Ecoregions (1994/95): 221Fa:CCC, 222Ag:CCC, 222An:CCC, 222Ca:CCC, 222De:CCC, 222Df:CCC, 222Dh:CCP, 222Di:CCP, 222Ek:CCC, 222Em:CCC, 222Fe:CCC, 222Ga:CCC, 222Gb:CCC, 222Gd:CCC, 222Ha:CCC, 222Hb:CCP, 222Hf:CCP, 222Jb:CCP, 222Jg:CCC, 222Jh:CCC, 222Ji:CCP, 222Jj:CCC, 222Kf:CCC, 222Kj:CCC, 231:C, 251Cf:CCC, 251Ci:CCC, 251Cj:CCC, 251Ck:CCC, 251Dc:CCC, 251Dd:CCC, 251Df:CCC, 251Dh:CCP
Federal Lands: NPS (Buffalo River, Cuyahoga Valley, Ozark Riverways); USFS (Chippewa, Shawnee)

ELEMENT SOURCES

Buffalo National River Plots: (13 plots): BUFF.039, BUFF.075, BUFF.080, BUFF.084, BUFF.133, BUFF.150, BUFF.151, BUFF.153, BUFF.166, BUFF.178, BUFF.711, BUFF.713, BUFF.731.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: M. Guetersloh
References: Anderson 1996, Braun 1950, Chapman et al. 1989, Chastain et al. 2006, Clark and Hutchinson 1994, Curtis 1959, Eyre 1980, Faircloth 1971, Foti 1994b, Foti et al. 1994, Fralish 1987, Fralish 1988b, Fralish et al. 1991, Gordon 1969, INAI unpubl. data, Illinois Nature Preserve Commission 1973, Jenkins and Pallardy 1993, Kuchler 1964, McNab and Avers 1994, Midwestern Ecology Working Group n.d., Mohlenbrock 1986, Nelson 1985, Nigh et al. 2000, Robertson et al. 1984, SAF 1967, TNC 1985, TNC 1995a, UNESCO 1973, Voigt and Mohlenbrock 1964, Wharton 1989, White and Madany 1978

M013. Eastern North American Ruderal Forest & Plantation

G030. Northern & Central Hardwood & Conifer Ruderal Forest

Ozark Honey-locust - Black Walnut Woodland

***Gleditsia triacanthos - Juglans nigra / Bromus secalinus - Poa pratensis* Successional Woodland**
Honey-locust - Black Walnut / Rye Brome - Kentucky Bluegrass Successional Woodland
Identifier: CEGL004345

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Eastern North American Ruderal Forest & Plantation (M013)

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Group	Northern & Central Hardwood & Conifer Ruderal Forest (G030)
Association (Common name)	Ozark Honey-locust - Black Walnut Woodland

ELEMENT CONCEPT

Global Summary: Stands are dominated by *Gleditsia triacanthos* (honeylocust) and *Juglans nigra* (black walnut). They may originate on lands that were formerly pastures or orchards. The ground layer is typically dominated by introduced grasses, including *Bromus secalinus* (rye brome) and *Poa pratensis* (Kentucky bluegrass). Other trees that may be present include *Prunus munsoniana* (wild goose plum), *Acer negundo* (box-elder), *Juniperus virginiana* (eastern red-cedar), *Ulmus alata* (winged elm), *Ulmus americana* (American elm), *Diospyros virginiana* (common persimmon), and the exotic *Ailanthus altissima* (tree of heaven). Other herbs include *Ageratina altissima* (white snakeroot), *Dicliptera brachiata* (branched foldwing), *Elephantopus carolinianus* (Carolina elephantsfoot), *Elymus macgregorii*, *Helianthus tuberosus* (Jerusalem artichoke), *Verbesina alternifolia* (wingstem), *Verbesina virginica* (white crownbeard), and *Smallanthus uvedalius* (hairy leafcup). Some stands have high cover of the exotic *Lolium arundinaceum* (tall fescue). Vines include *Parthenocissus quinquefolia* (Virginia creeper), *Cocculus carolinus* (Carolina coralbead), and *Vitis aestivalis* (summer grape). Other exotic species may include *Lonicera japonica* (Japanese honeysuckle), *Conium maculatum* (poison hemlock), and *Torilis arvensis* (spreading hedgeparsley).

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This ruderal successional woodland was sampled at three locations in the park. The sites are either temporarily flooded stream terraces and floodplains or moderately sloped hills. Soils are moderately well-drained to poorly drained silt loam. The unvegetated surface is dominated by leaf litter (80-99% cover) with some small rocks (0-1%), wood (0-1%) and bare soil (0-20%). Evidence of disturbance includes past clearing, fire suppression and the presence of many invasive exotic plant species.

Global Environment: These are ruderal forests or woodlands (canopy cover may vary) dominated by weedy trees including *Gleditsia triacanthos* (honeylocust) and *Juglans nigra* (black walnut) and other hardwoods, possibly with *Juniperus virginiana* (eastern red-cedar). Examples of this association occur at Buffalo National River over the Boone Formation, on soils weathered from limestone or cherty limestone. Some stands are on sites that may occasionally flood, but this is upland not wetland vegetation.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The very sparse to dense (10-80% cover) tree canopy (5-20 m tall) is single-tiered and dominated by *Gleditsia triacanthos* (honeylocust); additional taxa may include *Juglans nigra* (black walnut) and *Ulmus americana* (American elm). The sparse (30-40%) tall-shrub layer (2-5 m) and very sparse (5-10%) short-shrub layer (0.5-1 m) are made up of canopy species as well as *Ailanthus altissima* (tree of heaven), *Prunus munsoniana* (wild goose plum), and *Ulmus alata* (winged elm). The continuous (100%) herbaceous layer may be dominated by *Ageratina altissima* (white snakeroot), *Bromus secalinus* (rye brome), *Conium maculatum* (poison hemlock), *Dicliptera brachiata* (branched foldwing), *Elephantopus carolinianus* (Carolina elephantsfoot), *Elymus macgregorii*, *Helianthus tuberosus* (Jerusalem artichoke), *Poa pratensis* (Kentucky bluegrass), *Torilis arvensis* (spreading hedgeparsley), and/or *Verbesina alternifolia* (wingstem). Common vines (5-20%) include *Cocculus carolinus* (Carolina coralbead), *Lonicera japonica* (Japanese honeysuckle), and *Parthenocissus quinquefolia* (Virginia creeper). Twenty exotic species were recorded from samples of this community.

Global Vegetation: Stands of this ruderal woodland are dominated by *Gleditsia triacanthos* (honeylocust) and *Juglans nigra* (black walnut). The ground layer is typically dominated by introduced grasses, including *Bromus secalinus* (rye brome) and *Poa pratensis* (Kentucky bluegrass). Other trees that may be present include *Prunus munsoniana* (wild goose plum), *Acer negundo* (box-elder), *Juniperus virginiana* (eastern red-cedar), *Ulmus alata* (winged elm), *Ulmus americana* (American elm), *Diospyros virginiana* (common persimmon), and the exotic *Ailanthus altissima* (tree of heaven). Other herbs include *Ageratina altissima* (white snakeroot), *Dicliptera brachiata* (branched foldwing), *Elephantopus carolinianus* (Carolina elephantsfoot), *Elymus macgregorii*, *Helianthus tuberosus* (Jerusalem artichoke), *Verbesina alternifolia* (wingstem), *Verbesina virginica* (white crownbeard), and *Smallanthus uvedalius* (hairy leafcup). Some stands have high cover of the exotic *Lolium arundinaceum* (tall fescue). Vines include *Parthenocissus quinquefolia* (Virginia creeper), *Cocculus carolinus* (Carolina coralbead), and *Vitis aestivalis* (summer grape). Other exotic species may include *Lonicera japonica* (Japanese honeysuckle), *Conium maculatum* (poison hemlock), and *Torilis arvensis* (spreading hedgeparsley).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Gleditsia triacanthos* (honeylocust), *Juglans nigra* (black walnut)
Herb (field)	Graminoid	*Bromus secalinus* (rye brome)

CHARACTERISTIC SPECIES

Buffalo National River: *Bromus secalinus* (rye brome), *Gleditsia triacanthos* (honeylocust), *Juglans nigra* (black walnut)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Exotic/Invasive: *Ailanthus altissima* (tree of heaven, exotic, Medium), *Alliaria petiolata* (garlic mustard, exotic, High/Medium), *Allium vineale* (wild garlic, exotic, Medium/Insignificant), *Bromus secalinus* (rye brome, exotic), *Conium maculatum* (poison hemlock, exotic, Medium/Low), *Cruciata pedemontana* (piedmont-bedstraw, exotic), *Dactylis glomerata*

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(orchardgrass, exotic, Medium/Insignificant), *Daucus carota* (Queen Anne's lace, exotic, Low), *Dianthus armeria* (Deptford pink, exotic, Low/Insignificant), *Dioscorea oppositifolia* (Chinese yam, exotic, High/Medium), *Lespedeza cuneata* (sericea lespedeza, exotic, Medium), *Lonicera japonica* (Japanese honeysuckle, exotic, High/Medium), *Microstegium vimineum* (Nepalese browntop, exotic, High/Medium), *Perilla frutescens* (beefsteakplant, exotic, Low), *Poa pratensis* (Kentucky bluegrass, exotic, Medium), *Rosa multiflora* (multiflora rose, exotic, Medium/Low), *Rumex crispus* (curly dock, exotic, Low/Insignificant), *Torilis arvensis* (spreading hedgeparsley, exotic), *Trifolium campestre* (field clover, exotic), *Vicia sativa* (garden vetch, exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (4-Jun-2010). This vegetation represents vegetation created by anthropogenic disturbance and is thus not a conservation priority.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: This successional woodland has been observed (June 2009) at Buffalo National River, in Searcy County, Arkansas.

ELEMENT DISTRIBUTION

Buffalo National River Range: Stands were sampled along Rockwall Trail, near Tyler Bend and at the confluence of Buffalo River and Richland Creek.
Global Range: This successional woodland is found in the Ozark region of Arkansas and may occur in adjacent Missouri and Oklahoma in the southeastern United States.
Nations: US
States/Provinces: AR, MO?, OK
TNC Ecoregions: 38:C
USFS Ecoregions (1994/95): 222Ab:CCC, 222Ag:CCC, 222An:CCC, 231Aa:PPP, 231Gb:PPP
Federal Lands: NPS (Buffalo River); USFS (Ouachita (Mountains)?, Ouachita?, Ozark?)

ELEMENT SOURCES

Buffalo National River Plots: (3 plots): BUFF.128, BUFF.130, BUFF.736.
Local Description Authors: M.J. Russo
Global Description Authors: T. Foti and M. Pyne
References: Southeastern Ecology Working Group n.d.

Successional Black Locust Forest

***Robinia pseudoacacia* Forest**
Black Locust Forest
Identifier: CEGL007279

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Eastern North American Ruderal Forest & Plantation (M013)
Group	Northern & Central Hardwood & Conifer Ruderal Forest (G030)
Association (Common name)	Successional Black Locust Forest

ELEMENT CONCEPT

Global Summary: This black locust semi-natural forest is found locally throughout the eastern United States. Stands often establish on old fields abandoned after agricultural cropping or pasturing or around old homesites. In some areas it occurs on post-agricultural floodplain terraces. This vegetation has also become established following the planting of *Robinia pseudoacacia* (black locust) to stabilize and enrich nutrient-poor soils that are subject to erosion. The vegetation is dominated by *Robinia pseudoacacia* (black locust). Associated woody species vary from site to site and include *Prunus serotina* (black cherry), *Juniperus virginiana* (eastern red-cedar), *Ulmus americana* (American elm), *Ulmus rubra* (slippery elm), *Carya ovata* (shagbark hickory), *Celtis occidentalis* (common hackberry), *Juglans nigra* (black walnut), *Quercus rubra* (northern red oak), *Ulmus rubra* (slippery elm), and in some areas *Acer platanoides* (Norway maple) or *Ailanthus altissima* (tree of heaven). Understory vegetation is highly variable depending on site history and often includes *Toxicodendron radicans* (eastern poison-ivy); *Lindera benzoin* (northern spicebush) is sometimes present. The invasive non-native *Rosa multiflora* (multiflora rose) may be present as a shrub, along with the non-native bramble *Rubus phoenicolasius* (wine raspberry). Non-native species such as *Alliaria petiolata* (garlic mustard), *Chelidonium majus* (celandine), *Glechoma hederacea* (ground ivy), and *Convallaria majalis* (European lily of the valley) can characterize the herb layer, which may also have a native component.

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ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park. It probably occurs higher up, on Hale Formation shale benches (C. Biting, National Park Service, pers. comm.).

Global Environment: This type often establishes on old fields abandoned after agricultural cropping or pasturing or around old home sites. This vegetation has also become established following the planting of *Robinia pseudoacacia* (black locust) to stabilize and enrich nutrient-poor soils that are subject to erosion (Rabie 2000). Soils are variable and may be highly acidic, especially where established on old mine sites.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.

Global Vegetation: The vegetation is dominated by *Robinia pseudoacacia* (black locust) forming a partial to nearly complete canopy. Associated woody species vary from site to site and include *Prunus serotina* (black cherry), *Juniperus virginiana* (eastern red-cedar), *Ulmus americana* (American elm), *Ulmus rubra* (slippery elm), *Carya ovata* (shagbark hickory), *Celtis occidentalis* (common hackberry), *Juglans nigra* (black walnut), *Quercus rubra* (northern red oak), *Ulmus rubra* (slippery elm), *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), and in some areas *Acer platanoides* (Norway maple) or *Ailanthus altissima* (tree of heaven). Understory vegetation is highly variable depending on site history and often includes *Toxicodendron radicans* (eastern poison-ivy); *Lindera benzoin* (northern spicebush) is sometimes present. The invasive non-natives *Rosa multiflora* (multiflora rose) and *Elaeagnus umbellata* (autumn olive) are typically the most common shrubs, along with the non-native bramble *Rubus phoenicolasius* (wine raspberry). *Cornus florida* (flowering dogwood) may be present in the subcanopy. Non-native species such as *Alliaria petiolata* (garlic mustard), *Chelidonium majus* (celandine), *Glechoma hederacea* (ground ivy), *Dactylis glomerata* (orchardgrass), *Daucus carota* (Queen Anne's lace), and *Convallaria majalis* (European lily of the valley) can characterize the herb layer, which may have a native component as well, for example with (depending on geography) *Ageratina altissima* (white snakeroot), *Dichanthelium clandestinum* (deertongue), *Elymus hystrix var. hystrix* (eastern bottlebrush grass), *Leersia virginica* (whitegrass), *Parthenocissus quinquefolia* (Virginia creeper), *Pilea pumila* (Canadian clearweed), *Solidago canadensis* (Canada goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), *Verbesina alternifolia* (wingstem), *Verbesina occidentalis* (yellow crownbeard), and *Viola* (violet) spp.

MOST ABUNDANT SPECIES

Global

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Robinia pseudoacacia* (black locust)

CHARACTERISTIC SPECIES

Global: *Acer rubrum* (red maple), *Robinia pseudoacacia* (black locust), *Rosa multiflora* (multiflora rose)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (24-Oct-2002). Although *Robinia pseudoacacia* (black locust) is a native species found in the Central Appalachians and Ozark Mountains, it does not typically become a dominant species in these natural habitats (Elias 1980). It is now widespread in the eastern U.S. in disturbed habitats. This forest represents early-successional vegetation and is thus not of high conservation concern and does not receive a conservation status rank.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Buffalo National River Comments: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.

Global Similar Associations:

Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana - (Robinia pseudoacacia) Forest (CEGL006599) can have *Robinia* as an important canopy component but is not dominated by it as is this type.

Prunus serotina - Sassafras albidum - (Fraxinus americana) / Juniperus virginiana Forest (CEGL004133)

Robinia pseudoacacia - Celtis occidentalis - (Fraxinus americana, Liriodendron tulipifera) Forest (CEGL007281)

Global Related Concepts:

Juglans nigra - Robinia pseudoacacia / Lonicera japonica / Verbesina alternifolia Association (Rawinski et al. 1996) **?**

Robinia pseudoacacia Successional Forest (Fleming et al. 2006) =

Successional / Modified Terrestrial Forest (Fleming et al. 2006) >

Successional black locust disturbed forests (CAP pers. comm. 1998) **?**

Successional communities (Ehrenfeld 1977) >

ELEMENT DISTRIBUTION

Buffalo National River Range: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park. Stands have been reported by Chuck Biting of the National Park Service (pers. comm.).

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Global Range: This black locust semi-natural forest is found locally throughout the eastern United States.
Nations: US
States/Provinces: AR, DC?, DE, IA, KY, MA, MD, MS, NC, NJ, NY, OK, PA, TN, VA, VT, WV
TNC Ecoregions: 38:C, 39:C, 43:C, 44:C, 48:C, 49:C, 50:C, 51:C, 59:C, 61:C, 62:C, 63:C
USFS Ecoregions (1994/95): 221Aa:CCP, 221Ab:CCC, 221Ae:CCC, 221Ai:CCC, 221Bc:CCC, 221Fa:CCC, 222Ab:CCC, 222Ag:CCC, 222An:CCC, 222Ic:CCC, 231Bh:CCC, 232:?, M212Ba:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCP, M221Ad:CCP, M221Ba:CCP, M221Bb:CCC, M221Bc:CCP, M221Bd:CCP, M221Be:CCC, M221Bf:CCP, M221Ca:CPP, M221Cb:CPP, M221Cc:CPP, M221Ce:CPP, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCP, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC
Federal Lands: NPS (Antietam, Appalachian Trail (Central Appalachians), Appalachian Trail (Southern Blue Ridge), Blue Ridge Parkway, Bluestone, Buffalo River?, C&O Canal, Cape Cod, Catoctin Mountain, George Washington Birthplace, Marsh-Billings-Rockefeller, Minute Man, Morristown, National Capital-East, New River Gorge, Saratoga, Vicksburg); USFS (George Washington, Jefferson, Monongahela, Nantahala, Ouachita, Ouachita (Mountains), Ozark, Pisgah); USFWS (Montezuma)

ELEMENT SOURCES

Buffalo National River Plots: None.
Local Description Authors: H. Summer
Global Description Authors: D. Faber-Langendoen, mod. S.C. Gawler and L.A. Sneddon
References: Baalman 1965, CAP pers. comm. 1998, Ehrenfeld 1977, Elias 1980, Fleming and Coulling 2001, Fleming and Patterson 2011a, Fleming et al. 2006, Gaertner 1955, Hoagland 2000, INAI unpubl. data, McDonald 1938, NRCS 2004a, Patterson 2008d, Rabie 2000, Rawinski et al. 1996, Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst et al. 2007, Vanderhorst et al. 2008

M016. Southern Hardwood & Pine Forest

G601. Chinkapin Oak - Shumard Oak - Blue Ash Alkaline Forest

Ozark Ashe's Juniper Glade Woodland

***Juniperus ashei / Cotinus obovatus / Carex eburnea - Rudbeckia missouriensis* Woodland**
Ashe's Juniper / American Smoketree / Bristleleaf Sedge - Missouri Orange Coneflower Woodland
Identifier: CEGL007833

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Southern Hardwood & Pine Forest (M016)
Group	Chinkapin Oak - Shumard Oak - Blue Ash Alkaline Forest (G601)
Association (Common name)	Ozark Ashe's Juniper Glade Woodland

ELEMENT CONCEPT

Global Summary: This community is found in the Ozarks region of the United States. It occurs on gently sloping exposures of dolomite (or possibly sometimes limestone). Soils are very rapidly drained and very shallow (0-40 cm). The canopy is open to closed (>25% cover), stunted (4-10 m tall), and dominated by *Juniperus ashei* (Ashe's juniper). Other species which form a minor component of the canopy are *Quercus muehlenbergii* (chinkapin oak), *Juniperus virginiana var. virginiana* (eastern red-cedar), *Fraxinus americana* (white ash), *Fraxinus quadrangulata* (blue ash), *Quercus stellata* (post oak), *Sideroxylon lanuginosum* (gum bully). The understory consists of *Cotinus obovatus* (American smoketree), *Cercis canadensis var. canadensis* (eastern redbud), and canopy species. *Rhus aromatica var. serotina* (fragrant sumac), *Ilex decidua* (possum-haw), *Hypericum prolificum* (shrubby St. Johnswort), *Diospyros virginiana* (common persimmon), *Frangula caroliniana* (Carolina buckthorn), *Celtis tenuifolia* (dwarf hackberry), *Chionanthus virginicus* (white fringetree), *Berchemia scandens* (Alabama supplejack), *Smilax bona-nox* (saw greenbrier), and *Smilax rotundifolia* (roundleaf greenbrier) are common shrubs. The dominant herb is *Carex eburnea* (bristleleaf sedge), which forms dense mats. Other herbs, especially present in small openings, include *Rudbeckia missouriensis* (Missouri orange coneflower), *Allium cernuum* (nodding onion), *Arabis canadensis* (sicklepod), *Croton capitatus* (hogwort), *Croton monanthogynus* (prairie tea), *Croton willdenowii* (Willdenow's croton), *Hedyotis nigricans var. nigricans* (diamondflowers), *Heliotropium tenellum* (pasture heliotrope), *Liatris cylindracea* (Ontario blazing star), *Liatris scariosa var. nieuwlandii* (Nieuwland's blazing star), *Palafoxia callosa* (small palafox), *Panicum virgatum* (switchgrass), *Parietaria pensylvanica* (Pennsylvania pellitory), *Pellaea glabella* (smooth cliffbrake), *Ruellia humilis* (fringeleaf wild petunia), and *Salvia azurea var. grandiflora* (pitcher sage). The dominant moss is *Pleurochaete squarrosa* (square pleurochaete moss).

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This juniper glade woodland was sampled at six locations in the park. Sites are moderate to somewhat steep, southwest-facing mid and upper slopes. Soils are rapidly drained to moderately well-drained sandy loam, silt loam and sand. The unvegetated surface is made up of leaf litter (10-57% cover), bedrock (10-40%), large rocks (5-30%), small rocks

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(5-20%), wood (0-10%), and bare soil (0-30%). Evidence of disturbance includes trails; one site experienced a severe fire a few year prior to sampling.

Global Environment: Stands occur on gently to steeply sloping exposures of dolomite (or possibly sometimes limestone). Soils are very rapidly drained and very shallow (0-40 cm) (Nelson 1985).

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The dominant layer in examples of this community is the sparse to very dense (30-90% cover) tall-shrub layer (2-5 m) of dominants *Juniperus ashei* (Ashe's juniper) (state-vulnerable) and *Juniperus virginiana* (eastern red-cedar) along with *Cercis canadensis* (eastern redbud), *Celtis tenuifolia* (dwarf hackberry), *Rhus aromatica* (fragrant sumac), and *Quercus muehlenbergii* (chinkapin oak) (constant). However, there may also be a sparse (5-40%) emergent tree layer (5-20 m) that includes the shrub dominants as well as *Quercus shumardii* (Shumard oak), *Carya glabra* (pignut hickory), and *Fraxinus quadrangulata* (blue ash). The sparse to very dense (20-90%) short-shrub layer (0.5-1 m) shares the same dominants as the tall-shrub layer. Common species in the herbaceous layer (5-70%) include *Euphorbia corollata* (flowering spurge), *Hedyotis nigricans* (diamondflowers), *Lespedeza virginica* (slender lespedeza), *Parthenocissus quinquefolia* (Virginia creeper), *Pellaea atropurpurea* (purple cliffbrake), *Manfreda virginica* (false aloe), *Opuntia humifusa* (devil's-tongue), *and Schizachyrium scoparium*. Others may include *Coreopsis grandiflora* (largeflower tickseed), *Echinacea pallida* (pale purple coneflower), *Rudbeckia missouriensis* (Missouri orange coneflower), This community also supports state-critically imperiled *Scleria verticillata* (low nutrush), state-imperiled *Carex mesochorea* (midland sedge) and *Nemastylis nuttallii* (Nuttall's pleatleaf), and state-vulnerable *Penstemon cobaea* (cobaea beardtongue).

Global Vegetation: The canopy is open to closed (>25% cover), stunted (4-10 m tall), and dominated by *Juniperus ashei* (Ashe's juniper). Other species which form a minor component of the canopy are *Quercus muehlenbergii* (chinkapin oak), *Juniperus virginiana var. virginiana* (eastern red-cedar), *Fraxinus americana* (white ash), *Fraxinus quadrangulata* (blue ash), *Quercus stellata* (post oak), *Sideroxylon lanuginosum* (gum bully). The understory consists of *Cotinus obovatus* (American smoketree), *Cercis canadensis var. canadensis* (eastern redbud), and canopy species. *Rhus aromatica var. serotina* (fragrant sumac), *Ilex decidua* (possum-haw), *Hypericum prolificum* (shrubby St. Johnswort), *Diospyros virginiana* (common persimmon), *Frangula caroliniana* (Carolina buckthorn), *Celtis tenuifolia* (dwarf hackberry), *Chionanthus virginicus* (white fringetree), *Berchemia scandens* (Alabama supplejack), *Smilax bona-nox* (saw greenbrier), and *Smilax rotundifolia* (roundleaf greenbrier) are common shrubs. The dominant herb is *Carex eburnea* (bristleleaf sedge), which forms dense mats. Other herbs, especially present in small openings, include *Rudbeckia missouriensis* (Missouri orange coneflower), *Allium cernuum* (nodding onion), *Arabis canadensis* (sicklepod), *Croton capitatus* (hogwort), *Croton monanthogynus* (prairie tea), *Croton willdenowii* (Willdenow's croton), *Hedyotis nigricans var. nigricans* (diamondflowers), *Heliotropium tenellum* (pasture heliotrope), *Liatris cylindracea* (Ontario blazing star), *Liatris scariosa var. nieuwlandii* (Nieuwland's blazing star), *Palafoxia callosa* (small palafox), *Panicum virgatum* (switchgrass), *Parietaria pensylvanica* (Pennsylvania pellitory), *Pellaea glabella* (smooth cliffbrake), *Ruellia humilis* (fringeleaf wild petunia), and *Salvia azurea var. grandiflora* (pitcher sage). Mosses and lichens may have high coverage. The most typical dominant moss is *Pleurochaete squarrosa* (square pleurochaete moss) (Nelson 1985).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree subcanopy	Needle-leaved tree	*Juniperus ashei* (Ashe's juniper), *Juniperus virginiana* (eastern red-cedar)
Tree subcanopy	Broad-leaved deciduous tree	*Quercus shumardii* (Shumard oak)
Shrub/sapling (tall & short)	Needle-leaved shrub	*Juniperus ashei* (Ashe's juniper), *Juniperus virginiana* (eastern red-cedar)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Quercus muehlenbergii* (chinkapin oak)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Carya glabra* (pignut hickory), *Quercus shumardii* (Shumard oak), *Quercus stellata* (post oak)

CHARACTERISTIC SPECIES

Buffalo National River: *Carya glabra* (pignut hickory), *Echinacea pallida* (pale purple coneflower), *Juniperus ashei* (Ashe's juniper), *Juniperus virginiana* (eastern red-cedar), *Quercus muehlenbergii* (chinkapin oak), *Quercus shumardii* (Shumard oak), *Quercus stellata* (post oak), *Rudbeckia missouriensis* (Missouri orange coneflower), *Schizachyrium scoparium* (little bluestem)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Carex mesochorea* (midland sedge, state-imperiled, G4G5), *Juniperus ashei* (Ashe's juniper, state-vulnerable, G5), *Nemastylis nuttallii* (Nuttall's pleatleaf, state-imperiled, G4), *Penstemon cobaea* (cobaea beardtongue, state-vulnerable, G4), *Scleria verticillata* (low nutrush, state-critically imperiled, G5); **Exotic/Invasive**: *Commelina communis* (Asiatic dayflower, exotic), *Lespedeza cuneata* (sericea lespedeza, exotic, Medium)

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CONSERVATION STATUS RANK

Global Rank & Reasons: G2? (11-Dec-1998). This association is naturally rare, being restricted to specialized edaphic conditions (thin soil over dolomite) on the Springfield Plateau and possibly elsewhere in the Ozark Mountains of Arkansas and Missouri. The fire dynamics of this community are not well understood. Where it occurs on private land, it is subject to clearing and grazing.

CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong
Global Comments: Excellent examples of this community are known from the White River Balds Natural Area (Mark Twain National Forest, Missouri).
Global Similar Associations:
Juniperus ashei Ozark Clifftop Woodland (CEGL004672)
Global Related Concepts:
Xeric Limestone/Dolomite Forest (Nelson 1985) >

ELEMENT DISTRIBUTION

Buffalo National River Range: This juniper glade woodland was sampled along Rush Mountain Road and north of Pruitt Bridge.
Global Range: This community is found in the Ozarks region of the United States.
Nations: US
States/Provinces: AR, MO, OK?
TNC Ecoregions: 38:C
USFS Ecoregions (1994/95): 222Ag:CCC, 222An:CCC
Federal Lands: NPS (Buffalo River); USFS (Mark Twain, Ozark)

ELEMENT SOURCES

Buffalo National River Plots: (5 plots): BUFF.186, BUFF.187, BUFF.188, BUFF.189, BUFF.207.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: A.S. Weakley
References: NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1985, Southeastern Ecology Working Group n.d.

Ozark Ashe's Juniper Clifftop Woodland

***Juniperus ashei* Ozark Clifftop Woodland**
Ashe's Juniper Ozark Clifftop Woodland
Identifier: CEGL004672

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Southern Hardwood & Pine Forest (M016)
Group	Chinkapin Oak - Shumard Oak - Blue Ash Alkaline Forest (G601)
Association (Common name)	Ozark Ashe's Juniper Clifftop Woodland

ELEMENT CONCEPT

Global Summary: This association includes *Juniperus ashei* (Ashe's juniper) woodlands occurring on rimrock bluffs and cliffs composed of dolomite (or possibly limestone) in the Ozark Highlands of the United States. These woodlands generally have a pure *Juniperus ashei* (Ashe's juniper) canopy with little other associated vascular flora. Lichens may be abundant on rocks and covering the ground. These woodlands are less diverse than the mixed *Juniperus ashei* (Ashe's juniper) woodlands that occur as glade complexes on less extreme sites in the Ozarks.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This juniper woodland was sampled at three locations in the park. Sites are moderate to somewhat steep upper slopes and ridgetops of any aspect. Soils are xeric rapidly to well-drained silt loam and sandy loam. The unvegetated surface is made up of leaf litter (20-75% cover), exposed bedrock (0-50%), large rocks (2-10%), small rocks (2-20%), wood (0-15%) and bare soil (1-10%). Evidence of disturbance includes trails and other human impacts.
Global Environment: Stands occur on rimrock bluffs and cliffs composed of dolomite (or possibly limestone) in the Ozark Highlands of the United States.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The very sparse (5-20% cover) tree canopy (5-20 m tall) is dominated by *Juniperus virginiana* (eastern red-cedar); additional taxa may include *Carya alba* (mockernut hickory), *Carya texana* (black hickory), and *Quercus stellata* (post oak). The sparse to moderate (30-60%) tall-shrub layer (2-5 m) is also dominated by *Juniperus virginiana* (eastern red-cedar), along with lesser amounts of *Cotinus obovatus* (American smoketree), *Fraxinus americana* (white ash), *Juniperus ashei* (Ashe's juniper), *Ostrya virginiana* (hophornbeam), *Quercus muehlenbergii* (chinkapin oak), and *Rhus aromatica* (fragrant sumac), among others. The sparse (10-30%) short-shrub layer (0.5-1 m) is generally made up of taxa from the upper layers, as well as *Vaccinium*

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(blueberry) spp. Common species in the herbaceous layer (30-60%) found at low cover include *Danthonia spicata* (poverty oatgrass), *Dichanthelium linearifolium* (slimleaf panicgrass), *Eupatorium altissimum* (tall thoroughwort), *Hedyotis nigricans* (diamondflowers), and *Helianthus divaricatus* (woodland sunflower).

Global Vegetation: These woodlands generally have a pure *Juniperus ashei* (Ashe's juniper) canopy with little other associated vascular flora. Lichens may be abundant on rocks and covering the ground.

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Juniperus virginiana* (eastern red-cedar)
Tall shrub/sapling	Needle-leaved shrub	*Juniperus virginiana* (eastern red-cedar)

CHARACTERISTIC SPECIES

Buffalo National River: *Carya texana* (black hickory), *Dichanthelium linearifolium* (slimleaf panicgrass), *Eupatorium altissimum* (tall thoroughwort), *Juniperus ashei* (Ashe's juniper), *Juniperus virginiana* (eastern red-cedar)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Juniperus ashei* (Ashe's juniper, state-vulnerable, G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2? (2-Jan-2001). This association is restricted to rimrock bluffs and cliffs in the Ozark Highlands of the United States, ranging from Missouri to Arkansas and Oklahoma. This association is distinct from related woodlands which occur at part of a glade complex (e.g., *Juniperus ashei / Cotinus obovatus / Carex eburnea - Rudbeckia missouriensis* Woodland (CEGL007833)), as well as from extremely open dry cliffs on limestone and dolostone (Limestone - Dolostone Midwest Dry Cliff Sparse Vegetation (CEGL002291)). Field data and example locations are still needed to clarify the relationships among these types. This community is restricted to scattered, isolated sites which are probably not vulnerable to logging. Sites on private land could be subjected to quarrying for dolomite or limestone. Some examples are protected in the Mark Twain National Forest of Missouri.

CLASSIFICATION

Status: Standard

Classification Confidence: 1 - Strong

Buffalo National River Comments: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.

Global Comments: Excellent examples of this community are known from the Ashe Juniper Natural Area (Mark Twain National Forest, Missouri). The type is also reported from Mayes County, Oklahoma. The distinction between this type, which is found in cliff habitats, and *Juniperus ashei / Cotinus obovatus / Carex eburnea - Rudbeckia missouriensis* Woodland (CEGL007833), which is found in glade habitats, was agreed upon at an Ozarks-Ouachita Mountains region meeting (February 1997). These woodlands are less diverse than the mixed *Juniperus ashei* (Ashe's juniper) woodlands that occur as glade complexes on less extreme sites in the Ozarks. Field data and example locations are still needed to clarify their patterns, particularly in Missouri, where the need for this type is still under discussion (M. Leahy pers. comm. 1999, T. Nigh pers. comm. 1999). Very open examples of this type may also overlap with the sparse vegetation type Limestone - Dolostone Midwest Dry Cliff Sparse Vegetation (CEGL002291).

Global Similar Associations:

Juniperus ashei / Bouteloua (curtipendula, hirsuta) Woodland (CEGL002125)

Juniperus ashei / Cotinus obovatus / Carex eburnea - Rudbeckia missouriensis Woodland (CEGL007833)

Limestone - Dolostone Midwest Dry Cliff Sparse Vegetation (CEGL002291) has overlap with very open examples of CEGL004672.

Global Related Concepts:

Xeric Limestone/Dolomite Forest (Nelson 1985) >

ELEMENT DISTRIBUTION

Buffalo National River Range: This association was sampled at Kimball Bluff and along River View Trail.

Global Range: This association includes *Juniperus ashei* (Ashe's juniper) woodlands occurring on rimrock bluffs and cliffs composed of dolomite (or possibly limestone) in the Ozark Highlands of the United States, ranging from Missouri to Arkansas and Oklahoma.

Nations: US

States/Provinces: AR, MO, OK

TNC Ecoregions: 38:C

USFS Ecoregions (1994/95): 222Ab:CCC, 222Ag:CCC, 222An:CCC

Federal Lands: NPS (Buffalo River); USFS (Mark Twain, Ozark?)

ELEMENT SOURCES

Buffalo National River Plots: (3 plots): BUFF.070, BUFF.141, BUFF.142.

Local Description Authors: M.J. Russo

Global Description Authors: K.D. Patterson

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References: Hoagland 2000, Hopkins 1938, Leahy pers. comm., Little 1975, Little 1996, Nelson 1985, Nigh pers. comm., Southeastern Ecology Working Group n.d.

Red-cedar Alkaline Bluff Woodland

***Juniperus virginiana* Alkaline Bluff Woodland**
Eastern Red-cedar Alkaline Bluff Woodland
Identifier: CEGL002426

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Southern Hardwood & Pine Forest (M016)
Group	Chinkapin Oak - Shumard Oak - Blue Ash Alkaline Forest (G601)
Association (Common name)	Red-cedar Alkaline Bluff Woodland

ELEMENT CONCEPT

Global Summary: This red-cedar alkaline bluff woodland occurs in the Ozarks region of the United States. Stands may have been of minimal extent on blufftops of the White River region in southwestern Missouri. Soils are rapidly drained, very shallow (0-40 cm), and occur over cherty limestone or dolomite, or with bedrock partially exposed at the surface. The vegetation contains an open-tree canopy, sometimes clumped or irregular due to the exposed bedrock. A shrubby or viney layer may or may not be present. Along bluffs, the herbaceous layer is variable. Tree dominants include *Juniperus virginiana* (eastern red-cedar), with occasional hardwoods such as *Quercus muehlenbergii* (chinkapin oak) or *Fraxinus americana* (white ash). Ground layer dominants include *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass), and *Bouteloua curtipendula* (sideoats grama).

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This woodland was sampled at one location in the park on a bluff overlooking the Buffalo River. The site is a steep, northwest-facing ridgetop bedrock outcrop. The soil is a xeric rapidly drained silt. The unvegetated surface is made up of leaf litter (71% cover), exposed bedrock (20%), large rocks (3%), small rocks (3%), and wood (-1%). Evidence of disturbance includes its proximity to the River View Trail.
Global Environment: Stands may have been of minimal extent on blufftops of the White River region in southwestern Missouri. Soils are rapidly drained, very shallow (0-40 cm), and occur over cherty limestone or dolomite, or with bedrock partially exposed at the surface (Nelson 1985).

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The sparse (20% cover) tree canopy, 20-35 m tall, and sparse (30%) subcanopy (10-15 m) are codominated by *Quercus stellata* (post oak) and *Quercus muehlenbergii* (chinkapin oak). The moderate (40%) tall-shrub layer (1-5 m) and sparse (30%) short-shrub layer (0.5-2 m) are dominated by *Juniperus virginiana* (eastern red-cedar) and the canopy species; additional taxa include *Amelanchier arborea* (common serviceberry), *Cotinus obovatus* (American smoketree), *Rhus aromatica* (fragrant sumac), *Ostrya virginiana* (hophornbeam), and *Ulmus alata* (winged elm). The herbaceous layer (20%) includes *Danthonia spicata* (poverty oatgrass), *Helianthus divaricatus* (woodland sunflower), *Parthenocissus quinquefolia* (Virginia creeper), *Solidago ulmifolia var. palmeri* (Palmer's goldenrod), and *Toxicodendron radicans* (eastern poison-ivy). The site also supports state-imperiled *Brickellia grandiflora* (tasselflower brickellbush) and *Carex mesochorea* (midland sedge).
Global Vegetation: The vegetation contains an open-tree canopy, sometimes clumped or irregular due to the exposed bedrock. The shrubby or viney layer may or may not be present. Along bluffs, the herbaceous layer is variable. Tree dominants include *Juniperus virginiana* (eastern red-cedar), with occasional hardwoods, such as *Quercus muehlenbergii* (chinkapin oak) or *Fraxinus americana* (white ash). Ground layer dominants include *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass), and *Bouteloua curtipendula* (sideoats grama) (Nelson 1985).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Quercus muehlenbergii* (chinkapin oak), *Quercus stellata* (post oak)
Shrub/sapling (tall & short)	Needle-leaved shrub	*Juniperus virginiana* (eastern red-cedar)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Ostrya virginiana* (hophornbeam)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Quercus muehlenbergii* (chinkapin oak)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison-ivy)

CHARACTERISTIC SPECIES

Buffalo National River: *Juniperus virginiana* (eastern red-cedar), *Ostrya virginiana* (hophornbeam), *Quercus muehlenbergii* (chinkapin oak), *Quercus stellata* (post oak), *Rhus aromatica* (fragrant sumac), *Toxicodendron radicans* (eastern poison-ivy)

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OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Brickellia grandiflora* (tasselflower brickellbush, state-imperiled, G5), *Carex mesochorea* (midland sedge, state-imperiled, G4G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3 (8-Jan-2007).

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Buffalo National River Comments: Cluster analysis indicates that this association is closely related to *Quercus muehlenbergii - Fraxinus (quadrangulata*, *americana) / Schizachyrium scoparium* Woodland (CEGL002143).
Global Comments: The concept of the type is taken in part from the Missouri state classification - xeric limestone/dolomite forest (Nelson 1985). However, as described here, the type is restricted to blufftops, hence the understory description provided in Nelson may not entirely apply. The stands may have been of minimal extent on blufftops of the White River region in southwestern Missouri (T. Nigh. pers. comm. 2000). Otherwise, on flatter or gently sloping thin soil habitats, they were more commonly mixed with hardwoods, and can be treated as part of the *Quercus muehlenbergii - Fraxinus (quadrangulata*, *americana) / Schizachyrium scoparium* Woodland (CEGL002143) or, if more closed canopied, then as a fire-suppressed phase of *Quercus muehlenbergii - Fraxinus (quadrangulata*, *americana) / Schizachyrium scoparium* Woodland (CEGL002143).
Global Similar Associations:
Juniperus virginiana - Quercus (alba, stellata) - Carya texana Forest (CEGL004803)
Quercus muehlenbergii - Fraxinus (quadrangulata, americana) / Schizachyrium scoparium Woodland (CEGL002143)
Quercus muehlenbergii / Schizachyrium scoparium - Bouteloua curtipendula Wooded Herbaceous Vegetation (CEGL005284)
Global Related Concepts:
Limestone/Dolomite Savanna (Nelson 1985) ><
Xeric Limestone/Dolomite Forest (Nelson 1985) ><

ELEMENT DISTRIBUTION

Buffalo National River Range: This woodland was sampled on a bluff along River View Trail overlooking the Buffalo River.
Global Range: This type occurs in the Ozarks region of the United States. Stands may have been of minimal extent on blufftops of the White River region in southwestern Missouri.
Nations: US
States/Provinces: AR, MO
TNC Ecoregions: 38:C, 39:C
USFS Ecoregions (1994/95): 222Ag:CCC, 222An:CCC, 231Gb:CCC
Federal Lands: NPS (Buffalo River); USFS (Ouachita, Ouachita (Mountains), Ozark)

ELEMENT SOURCES

Buffalo National River Plots: (1 plot): BUFF.140.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: D. Faber-Langendoen
References: Midwestern Ecology Working Group n.d., Nelson 1985, Nigh pers. comm.

Chinkapin Oak - Ash / Little Bluestem Woodland

***Quercus muehlenbergii - Fraxinus (quadrangulata, americana) / Schizachyrium scoparium* Woodland**
Chinkapin Oak - (Blue Ash, White Ash) / Little Bluestem Woodland
Identifier: CEGL002143

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Southern Hardwood & Pine Forest (M016)
Group	Chinkapin Oak - Shumard Oak - Blue Ash Alkaline Forest (G601)
Association (Common name)	Chinkapin Oak - Ash / Little Bluestem Woodland

ELEMENT CONCEPT

Global Summary: This chinkapin oak - ash woodland community is found in the Ozark region of the United States, particularly Missouri and Arkansas. Stands occur on moderately steep to steep mid- to upper slopes of hills, ridges, and plains, and on steep slopes and bluffs along streams and rivers. Aspect can be in any direction, but most frequently southern to western. Soils are rapidly drained to well-drained, and very shallow to shallow (0-100 cm). The parent material is limestone, cherty limestone, or dolomite with rock fragments, boulders, or bedrock at or near the surface. The tree canopy is open, sometimes somewhat stunted or limby, and occasionally complex in pattern due to the bedrock influence. Tree canopies are short and slow-growing with slow replacement. Typical dominants include *Quercus muehlenbergii* (chinkapin oak), *Fraxinus americana* (white ash), and *Fraxinus quadrangulata* (blue ash), along with *Juniperus virginiana* (eastern red-cedar). Shrubs may include *Rhus aromatica* (fragrant sumac), *Frangula*

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caroliniana (Carolina buckthorn), *Crataegus* (hawthorn) spp., or more rarely, *Cotinus obovatus* (American smoketree). Dominant ground layer species include *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass), and *Bouteloua curtipendula* (sideoats grama). Other characteristic species include *Astragalus crassicarpus var. berlandieri* (groundplum milkvetch), *Galium arkansanum* (Arkansas bedstraw), *Ophioglossum engelmannii* (limestone adderstongue), *Polygala senega* (Seneca snakeroot), *Smilax bona-nox* (saw greenbrier), and, in more western stands of the Springfield Plateau, *Astragalus distortus* (Ozark milkvetch), *Berlandiera betonicifolia* (Texas greeneyes), and *Erysimum capitatum* (sanddune wallflower). With a lack of fire, canopies become more closed, and the canopy and subcanopy develop more coverage by *Acer saccharum* (sugar maple) and *Quercus alba* (white oak), with invasion by *Juniperus virginiana* (eastern red-cedar), and with denser subcanopy and shrub strata.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This chinkapin oak - ash woodland was sampled at seven locations in the park. Sites range from gentle to steep mid and upper hillslope and ridgetop bedrock outcrops of mostly south and east aspect. Soils range from xeric to dry-mesic, rapidly drained to well-drained sandy loam, silt loam, sand and clay loam. The unvegetated surface is made up of leaf litter (5-70% cover), exposed bedrock (4-40%), large rocks (0-40%), small rocks (0-40%), wood (0-3%), and bare soil (0-63%). Evidence of disturbance includes past fire, fire suppression, trails, and the presence of exotic plants.

Global Environment: Stands occur on moderately steep to steep upper slopes of hills, ridges, and plains, and on steep slopes and bluffs along streams and rivers. Aspect can be in any direction. Soils are rapidly drained to well-drained, and very shallow to shallow (0-100 cm). The parent material is limestone, cherty limestone, or dolomite with bedrock at or near the surface (Nelson 1985).

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The sparse (10-40% cover) tree canopy, 5-20 m tall, is dominated by *Quercus muehlenbergii* (chinkapin oak) and *Quercus stellata* (post oak); other species may include *Carya texana* (black hickory), *Fraxinus quadrangulata* (blue ash), *Juniperus virginiana* (eastern red-cedar), *Quercus rubra* (northern red oak), and *Quercus velutina* (black oak). A subcanopy is generally absent. The sparse to moderate (20-60%) tall-shrub layer (2-5 m) and sparse (5-30%) short-shrub layer (0.5-1 m) are dominated by *Juniperus virginiana* (eastern red-cedar) along with the dominant oaks. Additional shrubs may include *Amelanchier arborea* (common serviceberry), *Celtis tenuifolia* (dwarf hackberry), *Cercis canadensis* (eastern redbud), *Chionanthus virginicus* (white fringetree), *Fraxinus americana* (white ash), *Fraxinus quadrangulata* (blue ash), *Sideroxylon lanuginosum* (gum bully), *Symphoricarpos orbiculatus* (coralberry), *Ulmus alata* (winged elm), and *Viburnum rufidulum* (rusty blackhaw). The herbaceous layer (20-80%) may be dominated by *Andropogon gerardii* (big bluestem), *Danthonia spicata* (poverty oatgrass), *Dichanthelium acuminatum* (tapered rosette grass), *Grindelia lanceolata* (narrowleaf gumweed), and/or *Schizachyrium scoparium* (little bluestem). additional common species include *Euphorbia corollata* (flowering spurge), *Eupatorium altissimum* (tall thoroughwort), *Lespedeza procumbens* (trailing lespedeza), *Passiflora lutea* (yellow passionflower), *Pellaea atropurpurea* (purple cliffbrake), *Solidago ulmifolia* (elmleaf goldenrod), and *Toxicodendron radicans* (eastern poison-ivy), among many others. Vines (5%) include *Parthenocissus quinquefolia* (Virginia creeper), *Smilax bona-nox* (saw greenbrier), and *Vitis aestivalis* (summer grape). This community also supports state-imperiled *Brickellia grandiflora* (tasselflower brickellbush).

Global Vegetation: The tree canopy is open, sometimes somewhat stunted or limby, and occasionally complex in pattern due to the bedrock influence. Typical dominants include *Quercus muehlenbergii* (chinkapin oak), *Fraxinus americana* (white ash), and *Fraxinus quadrangulata* (blue ash), along with *Juniperus virginiana* (eastern red-cedar). Shrubs may include *Rhus aromatica* (fragrant sumac), *Frangula caroliniana* (Carolina buckthorn), *Chionanthus virginicus* (white fringetree), *Ilex decidua* (possum-haw), *Sideroxylon lanuginosum* (gum bully), *Viburnum rufidulum* (rusty blackhaw), *Crataegus* (hawthorn) spp., or more rarely, *Cotinus obovatus* (American smoketree). Dominant ground layer species include *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass), and *Bouteloua curtipendula* (sideoats grama). Other characteristic species include *Astragalus crassicarpus var. berlandieri* (groundplum milkvetch), *Galium arkansanum* (Arkansas bedstraw), *Hexalectris spicata* (spiked crested coralroot), *Hybanthus concolor* (eastern greenviolet), *Penstemon arkansanus* (Arkansas beardtongue), *Tragia cordata* (heartleaf noseburn), *Ophioglossum engelmannii* (limestone adderstongue), *Polygala senega* (Seneca snakeroot), *Smilax bona-nox* (saw greenbrier), and, in more western stands of the Springfield Plateau, *Astragalus distortus* (Ozark milkvetch), *Berlandiera betonicifolia* (Texas greeneyes), and *Erysimum capitatum* (sanddune wallflower) (Nelson 1985). Arkansas occurrences are often moderately steep, with associated species including *Cotinus obovatus* (American smoketree) and *Sideroxylon lanuginosum* (gum bully).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Quercus muehlenbergii* (chinkapin oak), *Quercus stellata* (post oak)
Shrub/sapling (tall & short)	Needle-leaved shrub	*Juniperus virginiana* (eastern red-cedar)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Quercus muehlenbergii* (chinkapin oak), *Quercus stellata* (post oak)
Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem), *Schizachyrium scoparium* (little bluestem)

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CHARACTERISTIC SPECIES

Buffalo National River: *Andropogon gerardii* (big bluestem), *Juniperus virginiana* (eastern red-cedar), *Quercus muehlenbergii* (chinkapin oak), *Quercus stellata* (post oak), *Schizachyrium scoparium* (little bluestem), *Smilax bona-nox* (saw greenbrier)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Brickellia grandiflora* (tasselflower brickellbush, state-imperiled, G5); **Exotic/Invasive**: *Bromus japonicus* (Japanese brome, exotic), *Cynosurus echinatus* (bristly dogstail grass, exotic, Medium/Low), *Lespedeza cuneata* (sericea lespedeza, exotic, Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (31-Mar-2000). Numerous small fire-suppressed sites exist, but there are few high-quality sites currently known or reported in the Missouri state databases.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: The concept of this type is taken in part from the Missouri state types limestone/dolomite savanna and dry limestone/dolomite forest (Nelson 1985). The latter concept is interpreted here as a fire-suppressed phase of the former. *Juniperus virginiana* (eastern red-cedar) increases without fire, and its relative dominance in this type can be variable. Closed chinquapin oak - red-cedar stands are considered a fire-suppressed phase of this community. Pure red-cedar woodlands along bluffs or cliffs are treated as a distinct type, *Juniperus virginiana* (eastern red-cedar) Alkaline Bluff Woodland (CEGL002426). More open limestone - dolostone savannas are placed in *Quercus muehlenbergii / Schizachyrium scoparium - Bouteloua curtipendula* Wooded Herbaceous Vegetation (CEGL005284).
Global Similar Associations:
Juniperus virginiana - Quercus (alba, stellata) - Carya texana Forest (CEGL004803)
Juniperus virginiana Alkaline Bluff Woodland (CEGL002426)
Quercus muehlenbergii / Schizachyrium scoparium - Bouteloua curtipendula Wooded Herbaceous Vegetation (CEGL005284)
Global Related Concepts:
Dry Limestone/Dolomite Forest (Nelson 1985) **<**
Limestone/Dolomite Savanna (Nelson 1985) **>**

ELEMENT DISTRIBUTION

Buffalo National River Range: This chinkapin oak - ash woodland was sampled near Buffalo Point, Lower Buffalo Wilderness Turkey Mountain (Hathaway Horse Camp) and Seven-mile Bend above Ludlow Bluff.
Global Range: This chinquapin oak - ash woodland community is found in the Ozark region of the United States, particularly Missouri and Arkansas.
Nations: US
States/Provinces: AR, MO
TNC Ecoregions: 36:C, 38:C
USFS Ecoregions (1994/95): 222Ab:CCC, 222Ac:CCC, 222Af:CCC, 222Ag:CCC, 222Ak:CC?, 222Am:CC?, 222An:CCC, 222Ao:CCC, 251Ce:CCC, M222Aa:CCC
Federal Lands: NPS (Buffalo River, Ozark Riverways); USFS (Mark Twain, Ozark)

ELEMENT SOURCES

Buffalo National River Plots: (7 plots): BUFF.021, BUFF.085, BUFF.094, BUFF.154, BUFF.155, BUFF.156, BUFF.709.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: P. Nelson, mod. D. Faber-Langendoen and M. Pyne
References: Midwestern Ecology Working Group n.d., Nelson 1985

Chinkapin Oak - Shumard Oak Ozark Forest

***Quercus muehlenbergii - Quercus shumardii* Forest**
Chinkapin Oak - Shumard Oak Forest
Identifier: CEGL004602

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Southern Hardwood & Pine Forest (M016)
Group	Chinkapin Oak - Shumard Oak - Blue Ash Alkaline Forest (G601)
Association (Common name)	Chinkapin Oak - Shumard Oak Ozark Forest

ELEMENT CONCEPT

Global Summary: This association occurs in lowlands and on mesic slopes over basic soils. Boulders or fragments of limestone or other basic rock may be present at the surface. It is abundant in the eastern half of Oklahoma, with localized occurrences in western

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Oklahoma; it ranges east to the Arkansas Ozarks and Ouachitas. In Oklahoma other characteristic species include *Aesculus glabra* (Ohio buckeye), *Carya cordiformis* (bitternut hickory), *Carya illinoinensis* (pecan), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Frangula caroliniana* (Carolina buckthorn), *Fraxinus americana* (white ash), *Myosotis verna* (spring forget-me-not), and *Quercus macrocarpa* (bur oak). Arkansas examples also may contain *Acer saccharum* (sugar maple), *Carya ovata* (shagbark hickory), *Quercus rubra* (northern red oak), and *Juglans nigra* (black walnut) in the canopy; *Carya ovalis* (red hickory), *Celtis occidentalis* (common hackberry), *Cercis canadensis var. canadensis* (eastern redbud), *Cladrastis kentukea* (Kentucky yellowwood), *Cornus florida* (flowering dogwood), *Fraxinus quadrangulata* (blue ash), *Magnolia acuminata* (cucumber-tree), and *Ulmus rubra* (slippery elm) in the subcanopy; *Asimina triloba* (pawpaw), *Cornus drummondii* (roughleaf dogwood), *Philadelphus pubescens* (hoary mock orange), *Ptelea trifoliata var. mollis* (common hoptree), and *Staphylea trifolia* (American bladdernut) as tall shrubs; and *Arundinaria gigantea* (giant cane), *Dirca palustris* (eastern leatherwood), *Hydrangea arborescens* (wild hydrangea), *Juniperus virginiana var. virginiana* (eastern red-cedar), *Lindera benzoin var. pubescens* (northern spicebush), *Sideroxylon lanuginosum* (gum bully), *Symphoricarpos orbiculatus* (coralberry), *Toxicodendron radicans ssp. negundo* (eastern poison-ivy), and *Viburnum rufidulum* (rusty blackhaw) as low shrubs. Herbs include *Aquilegia canadensis* (red columbine), *Arabis laevigata var. laevigata* (smooth rockcress), *Asarum canadense* (Canadian wildginger), *Asplenium platyneuron* (ebony spleenwort), *Asplenium resiliens* (blackstem spleenwort), *Chasmanthium latifolium* (Indian woodoats), *Cystopteris protrusa* (lowland bladderfern), *Dicentra cucullaria* (Dutchman's breeches), *Dioscorea quaternata* (fourleaf yam), *Dryopteris marginalis* (marginal woodfern), *Galium circaezans* (licorice bedstraw), *Geum canadense* (white avens), *Hybanthus concolor* (eastern greenviolet), *Hydrophyllum appendiculatum* (great waterleaf)?, *Lilium superbum* (turk's-cap lily), *Maianthemum racemosum* (feathery false lily of the valley), *Oxalis stricta* (common yellow oxalis), *Polymnia canadensis* (whiteflower leafcup), *Polystichum acrostichoides* (Christmas fern), *Silene ovata* (Blue Ridge catchfly), *Solidago caesia* (wreath goldenrod), and *Woodsia obtusa* (bluntlobe cliff fern). Additional information is needed regarding landscape position and floristics of this association across its range.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This chinquapin oak forest was sampled only once in the park along the Boxley Trail. The site is a steep, south-facing talus toeslope with well-drained silt loam soil. The unvegetated surface is made up of large rocks (50% cover), with some small rocks (15%), leaf litter (30%), wood (4%), and bare soil (1%). Evidence of disturbance includes roads/trails and fire within the last few years. In addition, the site is separated by a barbed-wire fence from a pasture located in the alluvial valley at the base of the talus slope.

Global Environment: This association occurs in lowlands and on mesic slopes over basic soils. Boulders or fragments of limestone or other basic rock may be present at the surface.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The moderate (50% cover) tree canopy, 20-35 m tall, and sparse (30%) subcanopy (10-15 m) are dominated by *Quercus muehlenbergii* (chinkapin oak) and *Carya cordiformis* (bitternut hickory), respectively, both with lesser amounts of *Juglans nigra* (black walnut) and *Ulmus rubra* (slippery elm). The sparse (20%) tall-shrub layer (5-10 m) and very sparse (10%) short-shrub layer (0.5-1 m) include *Acer saccharum* (sugar maple), *Asimina triloba* (pawpaw), *Carya cordiformis* (bitternut hickory), *Corylus americana* (American hazelnut), *Juniperus virginiana* (eastern red-cedar), *Morus rubra* (red mulberry), and *Ulmus rubra* (slippery elm). The dense (80%) herbaceous layer is dominated by *Polymnia canadensis* (whiteflower leafcup), *Clematis catesbyana* (satincurls), and *Toxicodendron radicans* (eastern poison-ivy). This community also supports globally and state-vulnerable *Tradescantia ozarkana* (Ozark spiderwort).

Global Vegetation: In Oklahoma other characteristic species include *Aesculus glabra* (Ohio buckeye), *Carya cordiformis* (bitternut hickory), *Carya illinoinensis* (pecan), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Frangula caroliniana* (Carolina buckthorn), *Fraxinus americana* (white ash), *Myosotis verna* (spring forget-me-not), and *Quercus macrocarpa* (bur oak). Arkansas examples also may contain *Acer saccharum* (sugar maple), *Carya ovata* (shagbark hickory), *Quercus rubra* (northern red oak), and *Juglans nigra* (black walnut) in the canopy; *Carya ovalis* (red hickory), *Celtis occidentalis* (common hackberry), *Cercis canadensis* (eastern redbud), *Cladrastis kentukea* (Kentucky yellowwood), *Cornus florida* (flowering dogwood), *Fraxinus quadrangulata* (blue ash), *Magnolia acuminata* (cucumber-tree), and *Ulmus rubra* (slippery elm) in the subcanopy; *Asimina triloba* (pawpaw), *Cornus drummondii* (roughleaf dogwood), *Philadelphus pubescens* (hoary mock orange), *Ptelea trifoliata var. mollis* (common hoptree), and *Staphylea trifolia* (American bladdernut) as tall shrubs; and *Arundinaria gigantea* (giant cane), *Dirca palustris* (eastern leatherwood), *Hydrangea arborescens* (wild hydrangea), *Juniperus virginiana* (eastern red-cedar), *Lindera benzoin var. pubescens* (northern spicebush), *Sideroxylon lanuginosum* (gum bully), *Symphoricarpos orbiculatus* (coralberry), *Toxicodendron radicans ssp. negundo* (eastern poison-ivy), and *Viburnum rufidulum* (rusty blackhaw) as low shrubs. Herbs include *Aquilegia canadensis* (red columbine), *Arabis laevigata* (smooth rockcress), *Asarum canadense* (Canadian wildginger), *Asplenium platyneuron* (ebony spleenwort), *Asplenium resiliens* (blackstem spleenwort), *Chasmanthium latifolium* (Indian woodoats), *Cystopteris protrusa* (lowland bladderfern), *Dicentra cucullaria* (Dutchman's breeches), *Dioscorea quaternata* (fourleaf yam), *Dryopteris marginalis* (marginal woodfern), *Galium circaezans* (licorice bedstraw), *Geum canadense* (white avens), *Hybanthus concolor* (eastern greenviolet), *Hydrophyllum appendiculatum* (great waterleaf)?, *Lilium superbum* (turk's-cap lily), *Maianthemum racemosum* (feathery false lily of the valley), *Oxalis stricta* (common yellow oxalis), *Polymnia canadensis* (whiteflower leafcup), *Polystichum acrostichoides* (Christmas fern), *Silene ovata* (Blue Ridge catchfly), *Solidago caesia* (wreath goldenrod), and *Woodsia obtusa* (bluntlobe cliff fern).

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MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus muehlenbergii* (chinkapin oak)
Tree subcanopy	Broad-leaved deciduous tree	*Carya cordiformis* (bitternut hickory)
Herb (field)	Forb	*Clematis catesbyana* (satincurls), *Polymnia canadensis* (whiteflower leafcup), *Toxicodendron radicans* (eastern poison-ivy)

CHARACTERISTIC SPECIES

Buffalo National River: *Asimina triloba* (pawpaw), *Carya cordiformis* (bitternut hickory), *Clematis catesbyana* (satincurls), *Corylus americana* (American hazelnut), *Morus rubra* (red mulberry), *Polymnia canadensis* (whiteflower leafcup), *Quercus muehlenbergii* (chinkapin oak), *Toxicodendron radicans* (eastern poison-ivy), *Ulmus rubra* (slippery elm)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Tradescantia ozarkana* (Ozark spiderwort, globally and state-vulnerable, G3)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G4 (15-Aug-1997).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: The relationship of dry to moist phases to the overall geographic distribution of this association and a related eastern type, *Quercus muehlenbergii - Quercus shumardii - Carya (carolinae-septentrionalis, ovata)* Forest (CEGL007808), is under investigation. Forest versus woodland placement of the type is uncertain.
Global Similar Associations:
Quercus muehlenbergii - Quercus shumardii - Carya (carolinae-septentrionalis, ovata) Forest (CEGL007808) is found east of the Mississippi River.
Quercus shumardii - Quercus muehlenbergii - Acer (barbatum, leucoderme, saccharum) / Ostrya virginiana Forest (CEGL008442)

ELEMENT DISTRIBUTION

Buffalo National River Range: This chinquapin oak forest was sampled along the Boxley Trail.
Global Range: This association is abundant in the eastern half of Oklahoma, with localized occurrences in western Oklahoma; it ranges east to the Arkansas Ozarks and Ouachitas.
Nations: US
States/Provinces: AR, OK
TNC Ecoregions: 32:C, 33:?, 37:C, 38:C, 39:C, 40:?
USFS Ecoregions (1994/95): 222A:CC, 251:P, M222Aa:CCC
Federal Lands: NPS (Buffalo River, Chickasaw NRA); USFS (Ozark); USFWS (Wichita Mountains)

ELEMENT SOURCES

Buffalo National River Plots: (1 plot): BUFF.026.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: B. Hoagland
References: Blair and Hubbell 1938, Galloway 1963, Galloway 1964, Hoagland 2000, Roe 1998, Southeastern Ecology Working Group n.d.

G012. Shortleaf Pine - Oak Forest

Interior Highlands Shortleaf Pine - Oak Dry-Mesic Forest

***Pinus echinata - Quercus (alba, rubra) / Vaccinium (arboreum, pallidum) / Schizachyrium scoparium - Chasmanthium sessiliflorum - Solidago ulmifolia* Forest**
Shortleaf Pine - (White Oak, Northern Red Oak) / (Farkleberry, Hillside Blueberry) / Little Bluestem - Longleaf Woodoats - Elmleaf Goldenrod Forest
Identifier: CEGL007489

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Southern Hardwood & Pine Forest (M016)
Group	Shortleaf Pine - Oak Forest (G012)
Association (Common name)	Interior Highlands Shortleaf Pine - Oak Dry-Mesic Forest

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ELEMENT CONCEPT

Global Summary: This upland, subxeric to submesic shortleaf pine - oak forest community is the matrix forest community of the Ouachita Mountains and surrounding areas, ranging from eastern Oklahoma to western Arkansas and southern Missouri. Stands occur on upper to middle, south-facing slopes, saddles, and flatter ridgelines. Soils are shallow to deep (25-100 cm). Parent material is a variety of sandstone and mixed sandstone-shale-derived substrates, or, in parts of the Missouri Ozarks, chert substrates. The canopy is dominated by *Pinus echinata* (shortleaf pine) codominating with *Quercus alba* (white oak), *Quercus rubra* (northern red oak), or *Quercus velutina* (black oak), either singly or in combination. Shortleaf pine often forms an emergent canopy over the oaks. *Carya texana* (black hickory) or *Cornus florida* (flowering dogwood) are typical subcanopy components. Other trees in the canopy and subcanopy can include *Acer rubrum* (red maple), *Amelanchier arborea* (common serviceberry), *Carya alba* (mockernut hickory), *Nyssa sylvatica* (blackgum), *Ostrya virginiana* (hophornbeam), *Quercus falcata* (southern red oak), and *Quercus stellata* (post oak). There is little understory, and the shrub layer is typically open with *Vaccinium pallidum* (Blue Ridge blueberry) common as a low shrub and *Vaccinium arboreum* (farkleberry) as a locally abundant tall shrub. Other species in the shrub stratum vary among occurrences but can include *Callicarpa americana* (American beautyberry), *Lyonia ligustrina* (maleberry), *Morus rubra* (red mulberry), *Sassafras albidum* (sassafras), *Styrax americanus* (American snowbell), and *Ulmus alata* (winged elm), and the vines *Smilax glauca* (cat greenbrier), *Smilax bona-nox* (saw greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis rotundifolia* (muscadine). The density of the herbaceous stratum varies with age of the stand and disturbance history but increases with fire. Composition of the herbaceous stratum in these forests can be quite diverse but tends to vary among occurrences. Most examples of this association exist with sparse shrub and herb strata and ground cover dominated by leaf litter. Typical herbaceous species include *Antennaria parlinii* (Parlin's pussytoes), *Antennaria plantaginifolia* (woman's tobacco), *Symphyotrichum anomalum* (manyray aster), *Symphyotrichum patens* (late purple aster), *Brachyelytrum erectum* (bearded shorthusk), *Chasmanthium latifolium* (Indian woodoats), *Chasmanthium sessiliflorum* (longleaf woodoats), *Danthonia spicata* (poverty oatgrass), *Desmodium glabellum* (Dillenius' ticktrefoil), *Desmodium laevigatum* (smooth ticktrefoil), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Desmodium rotundifolium* (prostrate ticktrefoil), *Dichanthelium linearifolium* (slimleaf panicgrass), *Dichanthelium boscii* (Bosc's panicgrass), *Dichanthelium commutatum* (variable panicgrass), *Helianthus divaricatus* (woodland sunflower), *Helianthus hirsutus* (hairy sunflower), *Helianthus X laetiflorus* (cheerful sunflower), *Hieracium gronovii* (queendevil), *Hypericum hypericoides ssp. hypericoides* (St. Andrew's cross), *Piptochaetium avenaceum* (blackseed speargrass), *Schizachyrium scoparium* (little bluestem), *Solidago hispida* (hairy goldenrod), *Solidago odora* (anisescented goldenrod), *Solidago ulmifolia* (elmleaf goldenrod), and *Viola pedata* (birdfoot violet). Fire increases coverage by grasses (*Schizachyrium scoparium* (little bluestem) and *Andropogon gyrans* (Elliott's bluestem)) and legumes. Although this is one of the most widespread forest types in the region, high quality, mature examples are uncommon. Mature, fire-suppressed examples loose the shortleaf pine and fire-tolerant species and show increases in stem density and fire-intolerant species. Mature, fire-maintained examples are extremely rare. Much of this forest community is managed to maintain specific tree densities and overstory composition.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This shortleaf pine - oak forest was sampled at 11 locations in the park. Sites range from moderate to somewhat steep, northwest-, west-, east-, southeast-, southwest- and south-facing slopes and benches. Soils are generally dry-mesic, rapidly drained to moderately well-drained sandy loam, silt loam, and clay loam. The unvegetated surface is dominated almost exclusively by leaf litter (94-99% cover) with some large rocks (0-3%), small rocks (0-1%), wood (1-3%), and bare soil (0-1%). Evidence of disturbance includes roads and trails, an old homesite, recent fire, possible insect damage, and the presence of exotic plants.

Global Environment: Stands occur on upper to middle, south-facing slopes, saddles, and flatter ridgelines. Soils are shallow to deep (25-100 cm). Parent material is a variety of sandstone and mixed sandstone-shale-derived substrates, or, in parts of the Missouri Ozarks, chert substrates (Zollner pers. comm. 1994, Nelson 1985).

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The sparse to very dense (40-90% cover) tree canopy, 15-35 m tall, is dominated by *Pinus echinata* (shortleaf pine), along with possible *Quercus alba* (white oak), *Quercus falcata* (southern red oak), *Quercus rubra* (northern red oak), and/or *Quercus velutina* (black oak). The sparse to dense (20-80%) subcanopy (10-20 m) includes canopy species as well as *Carya alba* (mockernut hickory), *Fraxinus americana* (white ash), *Nyssa sylvatica* (blackgum), and *Sassafras albidum* (sassafras). The very sparse to moderately dense (5-70%) tall-shrub layer (2-5 m) is dominated by *Cornus florida* (flowering dogwood) along with oak and hickory saplings, *Amelanchier arborea* (common serviceberry), *Frangula caroliniana* (Carolina buckthorn), *Fraxinus americana* (white ash), *Ostrya virginiana* (hophornbeam), *Sassafras albidum* (sassafras), *Ulmus alata* (winged elm), and *Vaccinium arboreum* (farkleberry). The very sparse to moderate (10-50%) short-shrub layer (0.5-1 m) is made up of tall-shrub species as well as *Castanea pumila var. ozarkensis* (Ozark chinkapin), *Diospyros virginiana* (common persimmon), *Nyssa sylvatica* (blackgum), *Sideroxylon lanuginosum* (gum bully), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), and *Viburnum rufidulum* (rusty blackhaw). The very sparse to moderate (10-50%) herbaceous layer includes *Agrimonia rostellata* (beaked agrimony), *Amphicarpaea bracteata* (American hogpeanut), *Aristolochia serpentaria* (Virginia snakeroot), *Cynoglossum virginianum* (wild comfrey), *Danthonia spicata* (poverty oatgrass), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Desmodium perplexum* (perplexed ticktrefoil), *Desmodium rotundifolium* (prostrate ticktrefoil), *Dichanthelium boscii* (Bosc's panicgrass), *Dichanthelium commutatum* (variable panicgrass), *Dichanthelium dichotomum* (cypress panicgrass), *Parthenocissus quinquefolia* (Virginia creeper),

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Smilax bona-nox (saw greenbrier), *Symphyotrichum patens* (late purple aster), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis aestivalis* (summer grape). This community also supports state-vulnerable *Carex hirtifolia* (pubescent sedge).

Global Vegetation: The canopy is dominated by *Pinus echinata* (shortleaf pine) codominating with *Quercus alba* (white oak), *Quercus rubra* (northern red oak), or *Quercus velutina* (black oak), either singly or in combination. Shortleaf pine often forms an emergent canopy over the oaks. *Carya texana* (black hickory) or *Cornus florida* (flowering dogwood) are typical subcanopy components. Other trees in the canopy and subcanopy can include *Acer rubrum* (red maple), *Amelanchier arborea* (common serviceberry), *Carya alba* (mockernut hickory), *Nyssa sylvatica* (blackgum), *Ostrya virginiana* (hophornbeam), *Quercus falcata* (southern red oak), and *Quercus stellata* (post oak). There is little understory, and the shrub layer is typically open with *Vaccinium pallidum* (Blue Ridge blueberry) common as a low shrub and *Vaccinium arboreum* (farkleberry) as a locally abundant tall shrub. Other species in the shrub stratum vary among occurrences but can include *Callicarpa americana* (American beautyberry), *Lyonia ligustrina* (maleberry), *Morus rubra* (red mulberry), *Sassafras albidum* (sassafras), *Styrax americanus* (American snowbell), and *Ulmus alata* (winged elm), and the vines *Smilax glauca* (cat greenbrier), *Smilax bona-nox* (saw greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis rotundifolia* (muscadine). The density of the herbaceous stratum varies with age of the stand and disturbance history but increases with fire. Composition of the herbaceous stratum in these forests can be quite diverse but tends to vary among occurrences. Most examples of this association exist with sparse shrub and herb strata and ground cover dominated by leaf litter. Typical herbaceous species include *Antennaria parlinii* (Parlin's pussytoes), *Antennaria plantaginifolia* (woman's tobacco), *Symphyotrichum anomalum* (manyray aster), *Symphyotrichum patens* (late purple aster), *Brachyelytrum erectum* (bearded shorthusk), *Chasmanthium latifolium* (Indian woodoats), *Chasmanthium sessiliflorum* (longleaf woodoats), *Danthonia spicata* (poverty oatgrass), *Desmodium glabellum* (Dillenius' ticktrefoil), *Desmodium laevigatum* (smooth ticktrefoil), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Desmodium rotundifolium* (prostrate ticktrefoil), *Dichanthelium linearifolium* (slimleaf panicgrass), *Dichanthelium boscii* (Bosc's panicgrass), *Dichanthelium commutatum* (variable panicgrass), *Helianthus divaricatus* (woodland sunflower), *Helianthus hirsutus* (hairy sunflower), *Helianthus X laetiflorus* (cheerful sunflower), *Hieracium gronovii* (queendevil), *Hypericum hypericoides ssp. hypericoides* (St. Andrew's cross), *Piptochaetium avenaceum* (blackseed speargrass), *Schizachyrium scoparium* (little bluestem), *Solidago hispida* (hairy goldenrod), *Solidago odora* (anisescented goldenrod), *Solidago ulmifolia* (elmleaf goldenrod), and *Viola pedata* (birdfoot violet). Fire increases coverage by grasses (*Schizachyrium scoparium* (little bluestem) and *Andropogon gyrans* (Elliott's bluestem)) and legumes (Zollner pers. comm. 1994, Nelson 1985).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Pinus echinata* (shortleaf pine)
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Quercus alba* (white oak)
Tree canopy	Broad-leaved deciduous tree	*Quercus falcata* (southern red oak), *Quercus rubra* (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	*Carya alba* (mockernut hickory)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Cornus florida* (flowering dogwood)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Quercus alba* (white oak)
Short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium pallidum* (Blue Ridge blueberry)
Herb (field)	Forb	*Desmodium nudiflorum* (nakedflower ticktrefoil), *Toxicodendron radicans* (eastern poison-ivy)

CHARACTERISTIC SPECIES

Buffalo National River: *Carya alba* (mockernut hickory), *Cornus florida* (flowering dogwood), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Fraxinus americana* (white ash), *Parthenocissus quinquefolia* (Virginia creeper), *Pinus echinata* (shortleaf pine), *Quercus alba* (white oak), *Quercus falcata* (southern red oak), *Quercus rubra* (northern red oak), *Toxicodendron radicans* (eastern poison-ivy), *Vaccinium pallidum* (Blue Ridge blueberry), *Vitis aestivalis* (summer grape)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Carex hirtifolia* (pubescent sedge, state-vulnerable, G5); **Exotic/Invasive**: *Albizia julibrissin* (silktree, exotic, High/Low)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (9-Jan-2001). The harvesting and management of this forest community, combined with long-term fire suppression, have blurred what, under historical ecosystem processes, would likely be several association-level communities. Although this is one of the most widespread forest types in the region, high-quality mature examples are uncommon. In mature, fire-suppressed examples, the component of *Pinus echinata* (shortleaf pine) and other fire-tolerant species declines, being replaced by greater canopy closure, higher stem density, and greater coverage of fire-intolerant species. Mature fire-maintained examples are extremely rare. Much of this forest community is managed to maintain specific tree densities and overstory composition.

CLASSIFICATION

Status: Standard

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Classification Confidence: 3 - Weak

Global Comments: The harvesting and management of this forest community, combined with long-term fire suppression, has blurred what, under historical ecosystem processes, would likely be several association-level communities. It may be better ranked as GM (D. Zollner pers. comm. 1998). Examples of this community are known from throughout the Ouachita National Forest, including Beech Creek Special Interest Area (LeFlore County, Oklahoma), Roaring Branch RNA (Polk County, Arkansas), Lake Winona RNA (Saline County, Arkansas), Dismal Hollow RNA (Newton County, Arkansas), McCurtain County Wilderness Area (McCurtain County, Oklahoma) and others. See related pure evergreen woodland associations, *Pinus echinata / Schizachyrium scoparium - Solidago ulmifolia - Monarda russeliana - Echinacea pallida* Woodland (CEGL007815) and the mixed pine - oak associations *Pinus echinata - Quercus alba / Schizachyrium scoparium* Woodland (CEGL002394) and *Pinus echinata - Quercus alba - Quercus falcata* Forest (CEGL004444). This forest type has been suggested to be a fire-suppressed version of these mixed pine - oak woodlands (M. Leahy pers. comm. 1999).

Global Similar Associations:

Pinus echinata - Quercus alba - Quercus falcata Forest (CEGL004444)
Pinus echinata - Quercus alba / Schizachyrium scoparium Woodland (CEGL002394)
Pinus echinata - Quercus velutina - Quercus stellata / Vaccinium spp. Forest (CEGL002401)
Pinus echinata / Schizachyrium scoparium - Solidago ulmifolia - Monarda russeliana - Echinacea pallida Woodland (CEGL007815)
Pinus echinata / Vaccinium (arboreum, pallidum, stamineum) Forest (CEGL002400)

Global Related Concepts:

Dry-Mesic Chert Forest (Nelson 1985) ><
Dry-Mesic Igneous Forest (Nelson 1985) ><
Dry-Mesic Sandstone Forest (Nelson 1985) ><
IA6a. Dry Shortleaf Pine - Oak - Hickory Forest (Allard 1990) >
Oak Pine Type (OP) (Dale and Kuroda 1979) **?**
Shortleaf Pine - Oak: 76 (Eyre 1980) >
T1B3aII3b. *Quercus alba - Pinus echinata - Quercus (velutina, falcata)* (Foti et al. 1994) **?**

ELEMENT DISTRIBUTION

Buffalo National River Range: This shortleaf pine - oak forest was sampled near Kimball Bluff, Dillard's Ferry, Tie Chute Bluff, Buffalo Point (including Indian Rockhouse Trail), Monte Cristo Trail, Pruitt Bridge, and Cedar Glade picnic area.

Global Range: This upland, subxeric to submesic forest community is the matrix forest community of the Ouachita Mountains and surrounding areas, ranging into areas adjacent to the Ouachitas and into the Ozarks of northern Arkansas, Oklahoma, and Missouri.

Nations: US

States/Provinces: AR, MO, OK

TNC Ecoregions: 38:C, 39:C

USFS Ecoregions (1994/95): 222Aa:CCC, 222Ad:CCC, 222Af:CCC, 222Ag:CCC, 222Aj:CCC, 222Al:CCC, 222An:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ac:CCC, M231Ad:CCC

Federal Lands: NPS (Buffalo River, Ozark Riverways); USFS (Ouachita, Ouachita (Mountains), Ozark)

ELEMENT SOURCES

Buffalo National River Plots: (11 plots): BUFF.074, BUFF.079, BUFF.083, BUFF.090, BUFF.093, BUFF.110, BUFF.111, BUFF.201, BUFF.204, BUFF.209, BUFF.716.

Local Description Authors: M.J. Russo and T. Foti

Global Description Authors: D. Zollner and K.D. Patterson

References: Allard 1990, Bruner 1931, Campbell et al. 1996, Chastain et al. 2006, Dale and Kuroda 1979, Duck and Fletcher 1945, Eyre 1980, Foti and Guldin 1994, Foti et al. 1994, Fountain and Sweeney 1985, Fountain and Sweeney 1987, Hoagland 2000, Johnson 1986a, Johnson 1986b, Kennedy 1973, Kreiter 1995, Leahy pers. comm., MNHP 2000, Masters et al. 1995, Nelson 1985, Rice 1963, Rice and Penfound 1959, Southeastern Ecology Working Group n.d., USFS 1990, Zollner pers. comm.

Ozark/Ouachita Shortleaf Pine - Oak Dry Woodland

***Pinus echinata - Quercus stellata - Quercus marilandica / Schizachyrium scoparium* Woodland**
Shortleaf Pine - Post Oak - Blackjack Oak / Little Bluestem Woodland
Identifier: CEGL002393

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Southern Hardwood & Pine Forest (M016)
Group	Shortleaf Pine - Oak Forest (G012)
Association (Common name)	Ozark/Ouachita Shortleaf Pine - Oak Dry Woodland

ELEMENT CONCEPT

Global Summary: This shortleaf pine - oak woodland is found in the Ozark/Ouachita region of the United States. Stands occur along ridges and on upper south- to southwest-facing slopes. The vegetation contains an open canopy dominated by *Pinus echinata*

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(shortleaf pine) codominating with *Quercus stellata* (post oak) and *Quercus marilandica* (blackjack oak), either singly or in combination. *Pinus echinata* (shortleaf pine) may form an emergent canopy over the oaks. Common woody associates include *Carya texana* (black hickory), *Quercus velutina* (black oak), and *Diospyros virginiana* (common persimmon). Grassy openings are dominated by *Schizachyrium scoparium* (little bluestem). Other abundant herbs include *Baptisia bracteata* (longbract wild indigo), *Helianthus hirsutus* (hairy sunflower), *Liatris aspera* (tall blazing star), *Solidago nemoralis* (gray goldenrod), *Solidago petiolaris* (downy ragged goldenrod), and *Tephrosia virginiana* (Virginia tephrosia). This type represents the driest shortleaf pine - oak communities in the Ozarks.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This shortleaf pine - oak woodland was sampled four times in the park. The sites steep to somewhat steep, south- and southwest-facing hillslope bedrock outcrops and scree noseslope. Soils are xeric, rapidly drained sand, loam and silt loam. The unvegetated surface is made up of leaf litter (25-88% cover), bedrock (0-7%), large rocks (1-5%), small rocks (1-63%), wood (2-4%), and bare soil (0-5%). Evidence of disturbance includes trails and past fire.
Global Environment: Stands occur along ridges and on upper south- to southwest-facing slopes. This type represents the driest shortleaf pine - oak communities in the Ozarks.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The sparse (10-40% cover) tree canopy, 10-20 m tall, and sparse (0-40%) subcanopy (10-15 m), when present, include *Carya texana* (black hickory), *Pinus echinata* (shortleaf pine), *Quercus stellata* (post oak), and *Quercus velutina* (black oak). The sparse to moderately dense (20-70%) tall-shrub layer (2-5 m) includes canopy species as well as *Juniperus virginiana* (eastern red-cedar), *Quercus marilandica* (blackjack oak), and *Sideroxylon lanuginosum* (gum bully), and the sparse (30-40%) short-shrub layer (0.5-1 m) includes *Rhus aromatica* (fragrant sumac), *Rhus copallinum* (winged sumac), and *Vaccinium stamineum* (deerberry). The herbaceous layer (5-70%) includes graminoids *Andropogon gerardii* (big bluestem), *Danthonia spicata* (poverty oatgrass), *Dichanthelium linearifolium* (slimleaf panicgrass), *Schizachyrium scoparium* (little bluestem), and *Scleria oligantha* (littlehead nutrush); common forbs include *Desmodium* (ticktrefoil) spp., *Euphorbia corollata* (flowering spurge), *Lespedeza* (lespedeza) spp., and *Symphyotrichum patens* (late purple aster). Vines include *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis aestivalis* (summer grape).
Global Vegetation: The vegetation contains an open canopy dominated by *Pinus echinata* (shortleaf pine) codominating with *Quercus stellata* (post oak) and *Quercus marilandica* (blackjack oak), either singly or in combination. *Pinus echinata* (shortleaf pine) may form an emergent canopy over the oaks. Common woody associates include *Carya texana* (black hickory), *Quercus velutina* (black oak), and *Diospyros virginiana* (common persimmon). Grassy openings are dominated by *Schizachyrium scoparium* (little bluestem). Other abundant herbs include *Baptisia bracteata* (longbract wild indigo), *Helianthus hirsutus* (hairy sunflower), *Liatris aspera* (tall blazing star), *Solidago nemoralis* (gray goldenrod), *Solidago petiolaris* (downy ragged goldenrod), and *Tephrosia virginiana* (Virginia tephrosia).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus echinata* (shortleaf pine)
Tree canopy	Broad-leaved deciduous tree	*Quercus stellata* (post oak)
Tree subcanopy	Broad-leaved deciduous tree	*Carya texana* (black hickory)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Quercus stellata* (post oak)
Herb (field)	Forb	*Lespedeza procumbens* (trailing lespedeza)
Herb (field)	Graminoid	*Danthonia spicata* (poverty oatgrass)

CHARACTERISTIC SPECIES

Buffalo National River: *Carya texana* (black hickory), *Danthonia spicata* (poverty oatgrass), *Dichanthelium linearifolium* (slimleaf panicgrass), *Lespedeza procumbens* (trailing lespedeza), *Pinus echinata* (shortleaf pine), *Quercus stellata* (post oak), *Quercus velutina* (black oak), *Rhus copallinum* (winged sumac), *Schizachyrium scoparium* (little bluestem), *Vaccinium stamineum* (deerberry)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (22-Oct-2002). High-quality examples of this community are rare throughout its range, most sites having been chronically fire-suppressed, resulting in a loss of the characteristic open canopy cover and the grassy understory. This community is also threatened by forest type conversion, and residential, agricultural, and commercial development. The final resolution of its rank and its rarity depends on the determination of its total global range. It is vulnerable to logging, development, invasion by exotic plant species, and fire exclusion. Shortleaf pine (*Pinus echinata* (shortleaf pine)) populations seem to have undergone rangewide declines in the vigor and extent. Stands of this association are threatened by the effects of continued fire suppression, which would inhibit the reproduction of *Pinus echinata* (shortleaf pine) and cause the grass-dominated herbaceous layer to deteriorate.

CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong

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Global Comments: See related oak-dominated vegetation in the *Quercus stellata - Quercus marilandica* Woodland Alliance (A.625), and see *Pinus echinata - Quercus velutina - Quercus stellata / Vaccinium* spp. Forest (CEGL002401), a similar dry forest type. The equivalent dry-mesic pine - oak type is *Pinus echinata - Quercus alba / Schizachyrium scoparium* Woodland (CEGL002394).

Global Similar Associations:
Pinus echinata - Quercus alba / Schizachyrium scoparium Woodland (CEGL002394) the dry-mesic pine - oak equivalent.
Pinus echinata - Quercus velutina - Quercus stellata / Vaccinium spp. Forest (CEGL002401)
Pinus echinata / Rock Outcrop Interior Highland Woodland (CEGL002402)
Pinus echinata / Vaccinium (arboreum, pallidum, stamineum) Forest (CEGL002400)

Global Related Concepts:
Chert Savanna (Nelson 1985) ><
Igneous Savanna (Nelson 1985) ><
Sandstone Savanna (Nelson 1985) ><
Shortleaf Pine - Oak: 76 (Eyre 1980) >

ELEMENT DISTRIBUTION

Buffalo National River Range: This shortleaf pine - oak woodland was sampled along Overlook Trail, above Ludlow Bluff near Seven-mile Bend, and in Gene Rush Wildlife Management Area.

Global Range: This shortleaf pine - oak woodland is found in the Ozark-Ouachita region of the United States, ranging from southern Missouri to Arkansas and eastern Oklahoma.

Nations: US
States/Provinces: AR, MO, OK:S2
TNC Ecoregions: 38:C, 39:C
USFS Ecoregions (1994/95): 222Ag:CCC, 222Am:CC?, 231G:CC, M222A:CC, M231A:CC
Federal Lands: NPS (Buffalo River, Ozark Riverways); USFS (Ouachita, Ouachita (Mountains), Ozark)

ELEMENT SOURCES

Buffalo National River Plots: (4 plots): BUFF.116, BUFF.708, BUFF.714, BUFF.756.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: D. Faber-Langendoen
References: Bruner 1931, Cantwell 1981, Chastain et al. 2006, Duck and Fletcher 1945, Eyre 1980, Hoagland 2000, Johnson 1986b, Kennedy 1973, Masters et al. 1995, Nelson 1985, Nigh et al. 2000, Osborn 1941, Rice 1963, Rice and Penfound 1959, Rosson 1995, Southeastern Ecology Working Group n.d., Taylor 1965, Turner et al. 1997, Zanoni et al. 1979

Interior Highlands Shortleaf Pine - Black Oak Forest

***Pinus echinata - Quercus velutina - Quercus stellata / Vaccinium* spp. Forest**
Shortleaf Pine - Black Oak - Post Oak / Blueberry species Forest
Identifier: CEGL002401

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Southern Hardwood & Pine Forest (M016)
Group	Shortleaf Pine - Oak Forest (G012)
Association (Common name)	Interior Highlands Shortleaf Pine - Black Oak Forest

ELEMENT CONCEPT

Global Summary: This shortleaf pine - oak forest is found primarily in the Interior Highlands of the United States, ranging from eastern Oklahoma to the southwestern corner of Illinois. Stands occur on gentle to moderately steep, mid- and upper slopes of hills and plains, especially on southern and western aspects of steep-walled valleys and canyons. Soils are thin, somewhat rapidly to rapidly drained, dry, rocky, and sandy. Bedrock is primarily sandstone and chert, although this forest can also occur on igneous rock, their commonality being acidic pH. Bedrock and rock fragments are often exposed near the surface. The tree canopy is short, spreading, open, and limby. It is dominated by *Pinus echinata* (shortleaf pine), which often forms an emergent canopy over a shorter canopy of oaks comprised of various combinations of *Quercus stellata* (post oak), *Quercus velutina* (black oak), *Quercus marilandica* (blackjack oak), and *Quercus alba* (white oak). *Carya texana* (black hickory) is a common subcanopy component. *Vaccinium arboreum* (farkleberry) and *Sassafras albidum* (sassafras) are common tall shrubs, while *Vaccinium pallidum* (Blue Ridge blueberry) often dominates the short-shrub stratum. Other characteristic shrubs can include *Castanea pumila var. ozarkensis* (Ozark chinkapin) and *Hypericum hypericoides* (St. Andrew's cross). Woody vines include *Smilax glauca* (cat greenbrier) and *Vitis rotundifolia* (muscadine). The ground cover is sparse and can be dominated by leaf litter with only scattered herbaceous species such as *Antennaria plantaginifolia* (woman's tobacco), *Baptisia alba var. macrophylla* (largeleaf wild indigo), *Baptisia bracteata var. leucophaea* (longbract wild indigo), *Clitoria mariana* (Atlantic pigeonwings), *Cunila origanoides* (common dittany), *Danthonia spicata* (poverty oatgrass), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dichanthelium commutatum* (variable panicgrass), *Dichanthelium linearifolium* (slimleaf panicgrass), *Elymus hystrix* (eastern bottlebrush grass), *Helianthus divaricatus* (woodland sunflower),

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Helianthus hirsutus (hairy sunflower), *Liatris aspera* (tall blazing star), *Pityopsis graminifolia* (narrowleaf silkgrass), *Schizachyrium scoparium* (little bluestem), *Solidago odora* (anisescented goldenrod), *Solidago ulmifolia* (elmleaf goldenrod), and *Tephrosia virginiana* (Virginia tephrosia). Numerous lichens and mosses can be found on rocks and stumps.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This shortleaf pine - oak forest was sampled at six locations in the park. Sites range from gentle, south- and west-facing interfluves to moderate, south- and southwest-facing mid- and upper slopes. Soils are xeric to dry-mesic, rapidly drained to moderately well-drained silt, silt loam, sandy loam and loam. The unvegetated surface is made up of leaf litter (65-99% cover), large rocks (0-1%), small rocks (1-30%), wood (1-4%), and bare soil (0-2%). Evidence of disturbance includes trails and past and very recent fire.

Global Environment: Stands occur on gentle to moderately steep, mid and upper slopes of hills and plains, especially on southern and western aspects of steep-walled valleys and canyons. Soils are thin, somewhat rapidly to rapidly drained, and dry, rocky, and sandy. Bedrock is primarily sandstone and chert, although this forest can also occur on igneous rock, their commonality being acidic pH. Bedrock and rock fragments are often exposed near the surface (Nelson 1985, TNC 1995a). In the central Ouachita Mountains of eastern Oklahoma and western Arkansas, this community usually occurs on bands of friable shale embedded within the novaculite uplift formation.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The sparse to dense (40-80% cover) tree canopy, 15-35 m tall, is dominated by *Pinus echinata* (shortleaf pine), *Quercus alba* (white oak), and *Quercus velutina* (black oak) and may include *Quercus falcata* (southern red oak), *Quercus marilandica* (blackjack oak), and *Quercus stellata* (post oak). The sparse to moderately dense (20-70%) subcanopy (10-20 m) is dominated by *Carya alba* (mockernut hickory), *Carya texana* (black hickory), *Pinus echinata* (shortleaf pine), *Quercus alba* (white oak), and *Quercus velutina* (black oak). The very sparse to dense (10-80%) tall-shrub layer (2-5 m) is comprised of canopy species as well as *Amelanchier arborea* (common serviceberry), *Cornus florida* (flowering dogwood), *Sassafras albidum* (sassafras), and *Ulmus alata* (winged elm). The very sparse to moderately dense (5-70%) short-shrub layer (0.5-1 m) is made up of sapling tree and tall-shrub species as well as *Diospyros virginiana* (common persimmon), *Frangula caroliniana* (Carolina buckthorn), *Fraxinus americana* (white ash), *Prunus serotina* (black cherry), *Rhus aromatica* (fragrant sumac), *Rhus copallinum* (winged sumac), *Vaccinium pallidum* (Blue Ridge blueberry), and *Vaccinium stamineum* (deerberry). The herbaceous layer (5-30%) may include *Amphicarpaea bracteata* (American hogpeanut), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Desmodium rotundifolium* (prostrate ticktrefoil), *Dichanthelium boscii* (Bosc's panicgrass), *Dichanthelium commutatum* (variable panicgrass), *Euphorbia corollata* (flowering spurge), *Helianthus divaricatus* (woodland sunflower), *Lespedeza hirta* (hairy lespedeza), *Lespedeza virginica* (slender lespedeza), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax bona-nox* (saw greenbrier), *Symphyotrichum patens* (late purple aster), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis aestivalis* (summer grape).

Global Vegetation: The tree canopy is short, spreading, open, and limby. It is dominated by *Pinus echinata* (shortleaf pine), which often forms an emergent canopy over a shorter canopy of oaks comprised of various combinations of *Quercus stellata* (post oak), *Quercus velutina* (black oak), *Quercus marilandica* (blackjack oak), and *Quercus alba* (white oak). *Carya texana* (black hickory) is a common subcanopy component. *Vaccinium arboreum* (farkleberry) and *Sassafras albidum* (sassafras) are common tall shrubs, while *Vaccinium pallidum* (Blue Ridge blueberry) often dominates the short-shrub stratum. Other characteristic shrubs can include *Castanea pumila var. ozarkensis* (Ozark chinkapin) and *Hypericum hypericoides* (St. Andrew's cross). Woody vines include *Smilax glauca* (cat greenbrier) and *Vitis rotundifolia* (muscadine). The ground cover is sparse and can be dominated by leaf litter with only scattered herbaceous species such as *Antennaria plantaginifolia* (woman's tobacco), *Baptisia alba var. macrophylla* (largeleaf wild indigo), *Baptisia bracteata var. leucophaea* (longbract wild indigo), *Clitoria mariana* (Atlantic pigeonwings), *Cunila origanoides* (common dittany), *Danthonia spicata* (poverty oatgrass), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dichanthelium commutatum* (variable panicgrass), *Dichanthelium linearifolium* (slimleaf panicgrass), *Elymus hystrix* (eastern bottlebrush grass), *Helianthus divaricatus* (woodland sunflower), *Helianthus hirsutus* (hairy sunflower), *Liatris aspera* (tall blazing star), *Pityopsis graminifolia* (narrowleaf silkgrass), *Schizachyrium scoparium* (little bluestem), *Solidago odora* (anisescented goldenrod), *Solidago ulmifolia* (elmleaf goldenrod), and *Tephrosia virginiana* (Virginia tephrosia). Numerous lichens and mosses can be found on rocks and stumps (Nelson 1985, TNC 1995a).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Pinus echinata* (shortleaf pine)
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Quercus alba* (white oak), *Quercus velutina* (black oak)
Tree subcanopy	Broad-leaved deciduous tree	*Carya alba* (mockernut hickory)
Short shrub/sapling	Broad-leaved deciduous shrub	*Sassafras albidum* (sassafras), *Vaccinium pallidum* (Blue Ridge blueberry)

Global

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus echinata* (shortleaf pine)

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Tree canopy	Broad-leaved deciduous tree	*Quercus marilandica* (blackjack oak), *Quercus stellata* (post oak), *Quercus velutina* (black oak)
Tree subcanopy	Needle-leaved tree	*Pinus echinata* (shortleaf pine)
Short shrub/sapling	Broad-leaved evergreen tree	*Vaccinium arboreum* (farkleberry)
Short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry)
Herb (field)	Forb	*Antennaria plantaginifolia* (woman's tobacco), *Cunila origanoides* (common dittany), *Hieracium gronovii* (queendevil)
Herb (field)	Graminoid	*Danthonia spicata* (poverty oatgrass), *Dichanthelium dichotomum* var. *dichotomum* (cypress panicgrass)

CHARACTERISTIC SPECIES

Buffalo National River: *Carya alba* (mockernut hickory), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Desmodium rotundifolium* (prostrate ticktrefoil), *Lespedeza procumbens* (trailing lespedeza), *Pinus echinata* (shortleaf pine), *Quercus alba* (white oak), *Quercus velutina* (black oak), *Sassafras albidum* (sassafras), *Vaccinium pallidum* (Blue Ridge blueberry)
Global: *Castanea pumila* var. *ozarkensis* (Ozark chinkapin), *Cladina subtenuis* (reindeer lichen), *Dicranum scoparium* (dicranum moss), *Flavoparmelia baltimorensis* (Baltimore flavoparmelia lichen), *Leucobryum glaucum* (leucobryum moss)

OTHER NOTEWORTHY SPECIES

Global: Other: *Accipiter striatus* (sharp-shinned hawk, G5), *Agkistrodon contortrix* (copperhead, G5), *Asio otus* (long-eared owl, G5), *Baeolophus bicolor* (tufted titmouse, G5), *Bonasa umbellus* (ruffed grouse, G5), *Carpodacus purpureus* (purple finch, G5), *Crotalus horridus* (timber rattlesnake, G4), *Dendroica coronata* (yellow-rumped warbler, G5), *Dendroica pinus* (pine warbler, G5), *Heterodon platirhinos* (eastern hog-nosed snake, G5), *Lampropeltis calligaster* (yellow-bellied kingsnake, G5), *Lampropeltis getula* (common kingsnake, G5), *Loxia curvirostra* (red crossbill, G5), *Lynx rufus* (bobcat, G5), *Masticophis flagellum* (coachwhip, G5), *Meleagris gallopavo* (wild turkey, G5), *Odocoileus virginianus* (white-tailed deer, G5), *Piranga rubra* (summer tanager, G5), *Scaphiopus holbrookii* (eastern spadefoot, G5), *Sceloporus undulatus* (fence/prairie/plateau lizard, G5), *Sciurus carolinensis* (eastern gray squirrel, G5), *Sitta canadensis* (red-breasted nuthatch, G5), *Tamias striatus* (eastern chipmunk, G5), *Terrapene carolina* (eastern box turtle, G5), *Troglodytes hiemalis* (winter wren, G5), *Ursus americanus* (american black bear, G5), *Vireo olivaceus* (red-eyed vireo, G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3 (20-May-2000). There are probably over 100 occurrences of this community rangewide. It is reported from Missouri (where it is ranked from S3 to S4S5), Illinois (S4), and the central Ouachita Mountains of Arkansas and Oklahoma. Currently there are 10 occurrences documented in Missouri. In Arkansas and Oklahoma high-quality examples are uncommon, but it is more common in the Ouachita Mountains than in the Ozarks. Throughout its range, this community is under severe pressure from fire suppression and silvicultural activities. There are probably over 3000 acres rangewide, and there may be more than 10,000 acres, but there has been an overall reduction in its aerial extant in the past 50 years. Currently over 260 acres are documented in Missouri, and all occurrences are less than 60 acres. This community was more widespread prior to heavy harvesting of shortleaf pine and the practice of fire suppression.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: The relation of this type to other dry shortleaf pine - oak forests in the Southeast needs further clarification, e.g., compare with *Pinus echinata - Quercus (alba, rubra) / Vaccinium (arboreum, pallidum) / Schizachyrium scoparium - Chasmanthium sessiliflorum - Solidago ulmifolia* Forest (CEGL007489). More open, fire-maintained stands may be classified as *Pinus echinata - Quercus stellata - Quercus marilandica / Schizachyrium scoparium* Woodland (CEGL002393). Logging of shortleaf pine may cause some classification difficulties when all or most of the mature specimens of this species have been removed. Compare to associations in *Pinus echinata - Quercus stellata - Quercus marilandica* Woodland Alliance (A.680) and *Pinus (echinata, taeda) - Quercus (stellata, marilandica, falcata)* Woodland Alliance (A.2011).
Global Similar Associations:
Pinus echinata - Quercus (alba, rubra) / Vaccinium (arboreum, pallidum) / Schizachyrium scoparium - Chasmanthium sessiliflorum - Solidago ulmifolia Forest (CEGL007489)
Pinus echinata - Quercus stellata - Quercus marilandica / Schizachyrium scoparium Woodland (CEGL002393)
Pinus echinata Crowley's Ridge Forest [Provisional] (CEGL007919)
Global Related Concepts:
Pinus echinata - Quercus velutina / Vaccinium arboreum / Danthonia spicata - Baptisia alba var. microphylla - Solidago odora Dry South-slope Woodland (Smith et al. 2000) **?**
Dry Chert Forest (Nelson 1985) ><
Dry Igneous Forest (Nelson 1985) ><
Dry Sandstone Forest (Nelson 1985) ><
Eastern Broadleaf and Needleleaf Forests: 111: Oak-Hickory-Pine Forest (*Quercus-Carya-Pinus*) (Kuchler 1964) >

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IA6a. Dry Shortleaf Pine - Oak - Hickory Forest (Allard 1990) >
Shortleaf Pine - Oak: 76 (Eyre 1980) >
Terrestrial: Forest: Hardwood (TNC 1985) >
UNESCO FORMATION CODE: I.B.2a (UNESCO 1973) >

ELEMENT DISTRIBUTION

Buffalo National River Range: This shortleaf pine - oak forest was sampled near Buffalo Point (including along Overlook Trail), near Tilting Rock, and Gene Rush Wildlife Management Area.
Global Range: This shortleaf pine - oak forest is found primarily in the Interior Highlands of the United States, ranging from eastern Oklahoma to the southwestern corner of Illinois. This community reaches its westernmost extension in the central Ouachitas of Oklahoma, but may have been widespread prior to excessive harvest of shortleaf pine. This community is still known from Missouri, southern Illinois, Arkansas, and Oklahoma.
Nations: US
States/Provinces: AR, IL, MO, OK
TNC Ecoregions: 38:C, 39:C, 44:C
USFS Ecoregions (1994/95): 222Aa:CCC, 222Af:CCC, 222Ag:CCC, 222Aj:CCC, 222Ak:CCC, 222An:CCC, 222Aq:CCC, 222D:CP, 231G:PP, M221:?, M222A:CC, M231Ab:CCC, M231Ac:CCC
Federal Lands: NPS (Buffalo River, Ozark Riverways); USFS (Mark Twain, Ouachita, Ouachita (Mountains), Ozark, Shawnee)

ELEMENT SOURCES

Buffalo National River Plots: (6 plots):BUFF.117, BUFF.118, BUFF.180, BUFF.218, BUFF.705, BUFF.715.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: M. Guetersloh, mod. K.D. Patterson
References: Allard 1990, Behler 1988, Braun 1950, Bruner 1931, Bull and Farrand 1977, Cantwell 1981, Chastain et al. 2006, Clark and Hutchinson 1994, Craighead 1949, Duck and Fletcher 1945, Duncan and Duncan 1988, Eyre 1980, Foti et al. 1994, Fountain and Sweeney 1985, Hoagland 2000, Illinois Nature Preserve Commission 1973, Johnson 1986b, Kennedy 1973, Kuchler 1964, Little 1938, Little 1980a, Masters et al. 1995, Midwestern Ecology Working Group n.d., Miller and Tehon 1929, Mohlenbrock 1986, Mohlenbrock and Voigt 1959, Nelson 1985, Niering 1979, Nigh et al. 2000, Osborn 1941, Powell 1985, Rice 1963, Rice and Penfound 1959, Rosson 1995, SAF 1967, Schwartz and Schwartz 1959, Smith et al. 2000, TNC 1985, TNC 1995a, Taylor 1965, Thornbury 1965, UNESCO 1973, Voigt and Mohlenbrock 1964, White and Madany 1978, Zanoni et al. 1979

Interior Highlands Shortleaf Pine / Blueberry Forest

***Pinus echinata / Vaccinium (arboreum, pallidum, stamineum)* Forest**
Shortleaf Pine / (Farkleberry, Hillside Blueberry, Deerberry) Forest
Identifier: CEGL002400

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Southern Hardwood & Pine Forest (M016)
Group	Shortleaf Pine - Oak Forest (G012)
Association (Common name)	Interior Highlands Shortleaf Pine / Blueberry Forest

ELEMENT CONCEPT

Global Summary: This shortleaf pine / blueberry forest type is found in the Interior Highlands region of the United States, including the Ouachita Mountains and Ozarks of Arkansas, Oklahoma, and Missouri. Stands occur on dry, thin-soil slopes. Soils may be somewhat acidic, often overlaying a variety of acidic bedrock substrates, including chert, igneous or sandstone material. This is a mid-successional to mature forest with the canopy dominated by *Pinus echinata* (shortleaf pine). A subcanopy of oaks, such as *Quercus alba* (white oak), *Quercus stellata* (post oak), and *Quercus falcata* (southern red oak), may be present and may succeed into the canopy in the prolonged absence of fire. *Cornus florida* (flowering dogwood) is also typically present. Shrub and herbaceous strata may be sparse to dense, with any of *Vaccinium arboreum* (farkleberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), or *Aesculus glabra* (Ohio buckeye) present. Dry forest herbs are typical. In northern Arkansas (Springfield Plateau), these forests occur naturally on steep slopes, over cherty residuum of the Boone Formation. They also occur on sandstone shelf bluffs in the Ozarks.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This shortleaf pine forest was sampled once in Gene Rush Wildlife Management Area. The site is a moderate, south-facing upper slope with rapidly drained silt loam soil. The unvegetated surface is codominated by leaf litter (39% cover) and small rocks (44%) with some wood (2%) and bare soil (15%). The site shows signs of past logging/thinning and fire.
Global Environment: Stands occur on dry, thin-soil slopes. Soils may be somewhat acidic, often overlaying a variety of acidic bedrock substrates, including chert, igneous or sandstone material. In northern Arkansas (Springfield Plateau), these forests occur naturally on steep slopes, over cherty residuum of the Boone Formation. They also occur on sandstone shelf bluffs in the Ozarks.

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VEGETATION DESCRIPTION

Buffalo National River Vegetation: The sparse (10% cover) tree canopy (10-15 m tall) is made up solely of *Pinus echinata* (shortleaf pine). The very sparse (5%) tall-shrub layer (2-5 m) and moderate (40%) short-shrub layer (0.5-1 m) are dominated by *Carya alba* (mockernut hickory); additional shrubs include sapling oaks and pines, as well as *Sassafras albidum* (sassafras) and *Vaccinium* (blueberry) spp. The moderate (50%) herbaceous layer is dominated by *Lespedeza* (lespedeza) spp. and *Desmodium* (ticktrefoil) spp.

Global Vegetation: This is a mid-successional to mature forest with the canopy dominated by *Pinus echinata* (shortleaf pine). A subcanopy of oaks, such as *Quercus alba* (white oak), *Quercus stellata* (post oak), and *Quercus falcata* (southern red oak), may be present and may succeed into the canopy in the prolonged absence of fire. *Cornus florida* (flowering dogwood) is also typically present. Shrub and herbaceous strata may be sparse to dense, with any of *Vaccinium arboreum* (farkleberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), or *Aesculus glabra* (Ohio buckeye) present. Dry forest herbs are typical.

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus echinata* (shortleaf pine)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Carya alba* (mockernut hickory)

CHARACTERISTIC SPECIES

Buffalo National River: *Carya alba* (mockernut hickory), *Pinus echinata* (shortleaf pine)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (24-Oct-2002). This type is found within the Interior Highlands region west of the Mississippi River on dry, thin-soil slopes with somewhat acidic soils. In northern Arkansas, these forests occur naturally over cherty residuum of the Boone Formation. They also occur on sandstone shelf bluffs in the Ozarks. Fire intensity is likely lower but more intense in this type compared to similar types (D. Zollner pers. comm. 1999). Lack of fire in some areas is leading to the succession of this type to a more oak-dominated canopy. Few EOs of this type have been documented.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Similar Associations:
Pinus echinata - Quercus (alba, rubra) / Vaccinium (arboreum, pallidum) / Schizachyrium scoparium - Chasmanthium sessiliflorum - Solidago ulmifolia Forest (CEGL007489) a related mixed forest.
Pinus echinata - Quercus stellata - Quercus marilandica / Schizachyrium scoparium Woodland (CEGL002393) in the Ouachitas and Boston Mountains, with an oak component.
Pinus echinata / Rock Outcrop Interior Highland Woodland (CEGL002402) drier and more open woodland.
Pinus echinata / Schizachyrium scoparium - Solidago ulmifolia - Monarda russeliana - Echinacea pallida Woodland (CEGL007815) a related evergreen woodland.
Pinus echinata Crowley's Ridge Forest [Provisional] (CEGL007919)
Global Related Concepts:
Dry Chert Forest (Nelson 1985) ><
Dry Igneous Forest (Nelson 1985) ><
Dry Sandstone Forest (Nelson 1985) ><
Shortleaf Pine - Oak: 76 (Eyre 1980) >

ELEMENT DISTRIBUTION

Buffalo National River Range: This shortleaf pine forest was sampled once in Gene Rush Wildlife Management Area south of Carver Bridge. Gene Rush WMA is located adjacent to Buffalo National River, but is not part of the NPS lands. This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.
Global Range: This shortleaf pine / blueberry forest type is found in the Interior Highlands region of the United States, including the Ouachita Mountains and Ozarks of Arkansas, Oklahoma, and Missouri.
Nations: US
States/Provinces: AR, MO, OK
TNC Ecoregions: 38:C, 39:C
USFS Ecoregions (1994/95): 221:C, 222A:CC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, M222A:CC, M231A:CC
Federal Lands: NPS (Buffalo River, Ozark Riverways); USFS (Mark Twain, Ouachita, Ouachita (Mountains), Ozark)

ELEMENT SOURCES

Buffalo National River Plots: (1 plot): BUFF.755.
Local Description Authors: M.J. Russo, mod. M. Pyne
Global Description Authors: D. Faber-Langendoen and K.D. Patterson

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References: Bruner 1931, Chastain et al. 2006, Duck and Fletcher 1945, Eyre 1980, Hoagland 2000, Johnson 1986b, Kreiter 1995, Masters et al. 1995, Midwestern Ecology Working Group n.d., Nelson 1985, Nigh et al. 2000, Rice 1963, Rice and Penfound 1959, TNC and ESRI 1994, Zollner pers. comm.

G159. South-Central Interior Oak Forest

Ozark Red-cedar - Hardwood Forest

***Juniperus virginiana - Quercus (alba, stellata) - Carya texana* Forest**
Eastern Red-cedar - (White Oak, Post Oak) - Black Hickory Forest
Identifier: CEGL004803

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Southern Hardwood & Pine Forest (M016)
Group	South-Central Interior Oak Forest (G159)
Association (Common name)	Ozark Red-cedar - Hardwood Forest

ELEMENT CONCEPT

Global Summary: These are mixed forests (often stunted) of *Juniperus virginiana* (eastern red-cedar), dry to xeric oaks, and other hardwoods; some stands may be fire-suppressed oak savannas. Stands are dominated by *Juniperus virginiana var. virginiana* (eastern red-cedar) and dry to xeric oaks, including *Quercus alba* (white oak) and *Quercus stellata* (post oak). This type is found in the Ozark region of Arkansas and may occur in adjacent Missouri and Oklahoma in the southeastern United States. Examples occur over a variety of geologies, including limestone, sandstone, and chert. Examples of this association are typically less calcareous than similar forests which are dominated by *Quercus muehlenbergii* (chinkapin oak). In Arkansas, associated species include *Ulmus alata* (winged elm), *Carya texana* (black hickory), *Fraxinus americana* (white ash), *Sideroxylon lycioides* (buckthorn bully), *Celtis tenuifolia* (dwarf hackberry), *Cercis canadensis* (eastern redbud), *Rhus aromatica* (fragrant sumac), *Symphoricarpos orbiculatus* (coralberry), *Viburnum rufidulum* (rusty blackhaw), *Antennaria plantaginifolia* (woman's tobacco), *Cheilanthes lanosa* (hairy lipfern), *Cheilanthes tomentosa* (woolly lipfern), *Euphorbia commutata* (tinted woodland spurge), and *Scutellaria ovata* (heartleaf skullcap). The precise structure and composition of vegetation in this type depend on management and disturbance history, as well as inherent site conditions. Depending on soil depth, climate, and fire interval, the canopy closure and the relative *Quercus / Juniperus* balance will vary considerably. At some sites, both forest and woodland stands may be present, grading into one another depending on aspect, surface geology, or fire history. With prolonged fire suppression, *Juniperus* (juniper) will increase in importance and stature, eventually occupying part of the canopy with the oaks, and resulting in greater canopy closure. In intermediate stages, an oak canopy will overtop a subcanopy of *Juniperus* (juniper). Drier, rockier, or more frequently burned examples will tend to exhibit an oak woodland physiognomy.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This eastern red-cedar forest - hardwood forest was sampled at four locations in the park. Sites are on moderate south- and southeast-facing mid and upper slopes and bedrock outcrops. Soils are xeric to dry-mesic moderately well-drained to rapidly drained sandy loam and silt loam. The unvegetated surface is dominated by leaf litter (68-90% cover) with some exposed bedrock (0-20%), large rocks (0-10%), small rocks (0-5%), wood (0-3%) and bare soil (0-5%). Evidence of disturbance includes erosion, trails, and past fire.
Global Environment: These are mixed forests (often stunted) of red-cedar and xeric oaks and other hardwoods. Examples of this association may occur over limestone, sandstone, or chert.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The very sparse to dense (10-80% cover) tree canopy (10-35 m tall) and the sparse to moderate (30-70%) subcanopy (5-20 m) are dominated by *Juniperus virginiana* (eastern red-cedar); *Carya texana* (black hickory) or *Quercus muehlenbergii* (chinkapin oak) may codominate. The sparse to moderate (20-70%) tall-shrub layer (2-5 m) and very sparse to sparse (5-40%) short-shrub layer (0.5-1 m) may be dominated by *Juniperus virginiana* (eastern red-cedar), *Ostrya virginiana* (hophornbeam), or *Vaccinium arboreum* (farkleberry); additional common shrubs include *Celtis tenuifolia* (dwarf hackberry), *Cercis canadensis* (eastern redbud), *Frangula caroliniana* (Carolina buckthorn), *Fraxinus americana* (white ash), *Quercus muehlenbergii* (chinkapin oak), and *Ulmus alata* (winged elm). The (5-60%) herbaceous layer (5-60%) is comprised of many species, but all at very low cover; commonly occurring taxa include *Danthonia spicata* (poverty oatgrass), *Dichanthelium boscii* (Bosc's panicgrass), *Dichanthelium dichotomum* (cypress panicgrass), *Parthenocissus quinquefolia* (Virginia creeper), *Ruellia pedunculata* (stalked wild petunia), *Schizachyrium scoparium* (little bluestem), *Toxicodendron radicans* (eastern poison-ivy), and *Woodsia obtusa* (bluntlobe cliff fern).
Global Vegetation: This is a mixed forest of *Juniperus virginiana* (eastern red-cedar), dry to xeric oaks, and other hardwoods. Stands may be stunted or the trees may be of a patchy or clumped distribution. Examples are composed of *Juniperus virginiana* (eastern red-cedar) and dry to xeric oaks, including *Quercus alba* (white oak) and *Quercus stellata* (post oak). In Arkansas, other reported associated species include *Ulmus alata* (winged elm), *Carya texana* (black hickory), *Fraxinus americana* (white ash), *Sideroxylon lycioides* (buckthorn bully), *Celtis tenuifolia* (dwarf hackberry), *Cercis canadensis* (eastern redbud), *Rhus aromatica* (fragrant sumac), *Symphoricarpos orbiculatus* (coralberry), *Viburnum rufidulum* (rusty blackhaw), *Antennaria plantaginifolia* (woman's tobacco),

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Cheilanthes lanosa (hairy lipfern), *Cheilanthes tomentosa* (woolly lipfern), *Euphorbia commutata* (tinted woodland spurge), and *Scutellaria ovata* (heartleaf skullcap). The composition is typically less calcareous-affiliated than similar forests with *Quercus muehlenbergii* (chinkapin oak) and *Quercus stellata* (post oak).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Juniperus virginiana* (eastern red-cedar)
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Carya texana* (black hickory), *Quercus muehlenbergii* (chinkapin oak)

CHARACTERISTIC SPECIES

Buffalo National River: *Juniperus virginiana* (eastern red-cedar), *Quercus muehlenbergii* (chinkapin oak)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Leavenworthia uniflora* (Michaux's gladecress, state-vulnerable, G4); **Exotic/Invasive**: *Stellaria media* (common chickweed, exotic, Low)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (22-Jun-2009). This element has not been ranked, pending the development of more complete information on its dynamics and relationship with other types. It is not a global or Arkansas state conservation priority, and it is not documented through Element Occurrences. The related woodlands are highly ranked, and this natural type could provide buffer to other more highly-ranked types.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: This association represents the hitherto undescribed geographic and conceptual "core" of the *Juniperus virginiana - Quercus (stellata*, *velutina*, *marilandica)* Forest Alliance (A.383). It is an Ozarkian element which has been observed (June 2009) at Buffalo National River.
Global Similar Associations:
Juniperus virginiana Alkaline Bluff Woodland (CEGL002426) related but more confined to blufftops and bluff edges.
Juniperus virginiana var. virginiana - Quercus spp. Forest (CEGL004731) of Tennessee's Highland Rim, not Ozarks.
Quercus alba - Quercus stellata - Quercus velutina / Schizachyrium scoparium Woodland (CEGL002150) possibly the predominantly deciduous woodland equivalent of CEGL004803.
Quercus muehlenbergii - Fraxinus (quadrangulata, americana) / Schizachyrium scoparium Woodland (CEGL002143) restricted to calcareous substrates, with *Quercus muehlenbergii* instead of *Quercus alba* and *Quercus stellata*.

ELEMENT DISTRIBUTION

Buffalo National River Range: This association was sampled along Buffalo River Trail, at Erbie Campground, and near Pruitt Bridge.
Global Range: This mixed red-cedar - hardwood forest is found in Ozark region of Arkansas and may occur in adjacent Missouri and Oklahoma in the southeastern United States.
Nations: US
States/Provinces: AR, MO?, OK
TNC Ecoregions: 38:C
USFS Ecoregions (1994/95): 222Ab:CCC, 222Ag:CCC, 222An:CCC, 231Aa:PPP, 231Gb:PPP
Federal Lands: NPS (Buffalo River); USFS (Ouachita (Mountains)?, Ouachita?, Ozark?)

ELEMENT SOURCES

Buffalo National River Plots: (5 plots): BUFF.041, BUFF.210, BUFF.222, BUFF.225, BUFF.738.
Local Description Authors: M.J. Russo
Global Description Authors: T. Foti and M. Pyne
References: Southeastern Ecology Working Group n.d.

White Oak - Red Oak Dry-Mesic Acidic Forest

***Quercus alba - Quercus rubra - Carya (alba, ovata) / Cornus florida* Acidic Forest**
White Oak - Northern Red Oak - (Mockernut Hickory, Shagbark Hickory) / Flowering Dogwood Acidic Forest
Identifier: CEGL002067

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Southern Hardwood & Pine Forest (M016)

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Group	South-Central Interior Oak Forest (G159)
Association (Common name)	White Oak - Red Oak Dry-Mesic Acidic Forest

ELEMENT CONCEPT

Global Summary: This community is found in the Interior Highlands of the south-central United States to the Western Allegheny Plateau. Stands occur on gentle to moderately steep slopes of dissected hills and plains. Soils are well-drained, shallow to deep, often over sandstone, cherts, or cherty limestone. Stands are dominated by a closed-canopy deciduous tree layer. The dominants are *Quercus alba* (white oak) and *Quercus rubra* (northern red oak). Typical associates include *Carya ovata* (shagbark hickory), *Carya alba* (mockernut hickory), *Carya ovalis* (red hickory), *Nyssa sylvatica* (blackgum), *Quercus falcata* (southern red oak), *Quercus velutina* (black oak), and *Pinus echinata* (shortleaf pine) in parts of the range. The shrub and small-tree layer contains *Cornus florida* (flowering dogwood). *Parthenocissus quinquefolia* (Virginia creeper) is a typical vine. The low-shrub layer may be dominated by *Vaccinium pallidum* (Blue Ridge blueberry). The herbaceous layer contains *Actaea racemosa* (black baneberry), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Galium pilosum* (hairy bedstraw), and *Polystichum acrostichoides* (Christmas fern).

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This common white oak - red oak forest was sampled at 19 locations in the park. Sites range from moderate to steep mid- and upper slopes and bedrock outcrops with any aspect. Soils are typically dry-mesic moderately well-drained to well-drained sandy loam, clay loam, silt loam, loam and silt. The unvegetated surface is usually dominated by leaf litter (13-98% cover), with some bedrock (0-10%), large rocks (0-20%), small rocks (0-30%), wood (1-15%), and bare soil (0-70%). Evidence of disturbance includes roads and trails and past fire; one site experienced an intense fire within the past year, killing all shrubs.

Global Environment: Soils are well-drained, shallow to deep (40 to over 100 cm), often over sandstone, cherts, or cherty limestone (Nelson 1985).

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The structure of this oak community is quite variable across the landscape, ranging from forests with closed canopies to woodlands with open canopies. The sparse to closed (30-100% cover) tree canopy, 10-35 m tall, is dominated by *Quercus alba* (white oak) and *Quercus rubra* (northern red oak); additional species may include *Carya alba* (mockernut hickory), *Quercus falcata* (southern red oak), and *Quercus velutina* (black oak), among others. The sparse to dense (20-80%) subcanopy (10-15 m) is dominated by *Quercus alba* (white oak), along with *Carya alba* (mockernut hickory), *Nyssa sylvatica* (blackgum), and *Quercus velutina* (black oak). The very sparse to dense (5-70%) tall-shrub layer (2-5 m) is dominated by *Cornus florida* (flowering dogwood) and may include saplings of tree species as well as *Acer rubrum* (red maple), *Amelanchier arborea* (common serviceberry), *Asimina triloba* (pawpaw), *Cercis canadensis* (eastern redbud), *Ostrya virginiana* (hophornbeam), *Prunus serotina* (black cherry), and *Sassafras albidum* (sassafras). The very sparse to moderate (5-70%) short-shrub layer (0.5-1 m) includes *Asimina triloba* (pawpaw), *Cornus florida* (flowering dogwood), *Frangula caroliniana* (Carolina buckthorn), *Sassafras albidum* (sassafras), and *Vaccinium pallidum* (Blue Ridge blueberry). The very sparse to continuous (10-100%) herbaceous layer; common herbs include *Amphicarpaea bracteata* (American hogpeanut), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dichanthelium boscii* (Bosc's panicgrass), *Sanicula canadensis* (Canadian blacksnakeroot), *Solidago caesia* (wreath goldenrod), and *Thalictrum thalictroides* (rue-anemone). Vines (up to 30% cover) include *Parthenocissus quinquefolia* (Virginia creeper), *Smilax bona-nox* (saw greenbrier), *Toxicodendron radicans* (eastern poison-ivy), *Vitis aestivalis* (summer grape), and *Vitis vulpina* (frost grape). This community also supports state-critically imperiled *Viburnum molle* (softleaf arrowwood), and globally and state-vulnerable *Delphinium newtonianum* (Newton's larkspur) and *Trillium pusillum var. ozarkanum* (Ozark wakerobin).

Global Vegetation: Stands are dominated by a closed-canopy deciduous tree layer. The dominants are *Quercus alba* (white oak) and *Quercus rubra* (northern red oak). Typical associates including *Carya ovata* (shagbark hickory), *Carya alba* (mockernut hickory), *Carya ovalis* (red hickory), *Nyssa sylvatica* (blackgum), *Quercus falcata* (southern red oak), *Quercus velutina* (black oak), and *Pinus echinata* (shortleaf pine) in parts of the range. The shrub and small-tree layer contains *Cornus florida* (flowering dogwood). *Parthenocissus quinquefolia* (Virginia creeper) is a typical vine. The low-shrub layer may be dominated by *Vaccinium pallidum* (Blue Ridge blueberry). The herbaceous layer contains *Actaea racemosa* (black baneberry), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Galium arkansanum* (Arkansas bedstraw), *Galium pilosum* (hairy bedstraw), and *Polystichum acrostichoides* (Christmas fern), among others (Nelson 1985). Other herbaceous plants observed in Arkansas stands include *Symphyotrichum anomalum* (manyray aster), *Hypericum hypericoides* (St. Andrew's cross), *Cunila origanoides* (common dittany), and *Lonicera dioica* (limber honeysuckle).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Carya alba* (mockernut hickory), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak)
Tree subcanopy	Broad-leaved deciduous tree	*Nyssa sylvatica* (blackgum)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Cornus florida* (flowering dogwood)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Nyssa sylvatica* (blackgum), *Quercus alba* (white oak)

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Short shrub/sapling	Broad-leaved deciduous shrub	*Asimina triloba* (pawpaw)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper)
Herb (field)	Forb	*Amphicarpaea bracteata* (American hogpeanut), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Toxicodendron radicans* (eastern poison-ivy)

CHARACTERISTIC SPECIES

Buffalo National River: *Amphicarpaea bracteata* (American hogpeanut), *Asimina triloba* (pawpaw), *Carya alba* (mockernut hickory), *Cornus florida* (flowering dogwood), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Nyssa sylvatica* (blackgum), *Parthenocissus quinquefolia* (Virginia creeper), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), *Toxicodendron radicans* (eastern poison-ivy), *Vitis aestivalis* (summer grape)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Delphinium newtonianum* (Newton's larkspur, globally and state-vulnerable, G3), *Trillium pusillum* var. *ozarkanum* (Ozark wakerobin, globally and state-vulnerable, G3T3), *Viburnum molle* (softleaf arrowwood, state-critically imperiled, G5); **Exotic/Invasive**: *Chenopodium album* (lambsquarters, exotic), *Lonicera japonica* (Japanese honeysuckle, exotic, High/Medium), *Perilla frutescens* (beefsteakplant, exotic, Low), *Poa pratensis* (Kentucky bluegrass, exotic, Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3 (24-Oct-2002). This community has a moderately restricted range, found primarily in the Interior Highlands of the south-central United States. Site factors are not particularly specific, but it may require a combination of thin acidic soils, occasional ground fires, and infrequent catastrophic fires to persist. Extensive clearing and use of oaks for lumber have contributed to the large decline in this forest type. Remaining parcels of this tract are subject to harvesting, but conversion is less likely. There are few areas where old forest (100- to 150-year-old stands) or old-growth forest (>150 years) conditions are present. Many stands have also been grazed in the past, resulting in ground and shrub layers that are simplified or prone to invasion by exotics. Stands may require low-intensity surface fires to maintain the quality of the ground layer, and these are often lacking.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: This type may be difficult to distinguish from *Quercus alba - Quercus rubra - Quercus muehlenbergii / Cercis canadensis* Forest (CEGL002070), the alkaline equivalent, but more acidic species such as *Cornus florida* (flowering dogwood), *Nyssa sylvatica* (blackgum) and *Pinus echinata* (shortleaf pine) may be present. Further characterization is needed.
Global Similar Associations:
Quercus (alba, rubra, velutina) / Cornus florida / Viburnum acerifolium Forest (CEGL006336)
Quercus alba - Carya alba - (Quercus velutina) / Desmodium nudiflorum - (Carex picta) Forest (CEGL007795) of the Interior Low Plateau.
Quercus alba - Carya alba / Chasmanthium sessiliflorum West Gulf Coastal Plain Forest (CEGL008413)
Quercus alba - Quercus rubra - Acer saccharum - Carya cordiformis / Lindera benzoin Forest (CEGL002058)
Quercus alba - Quercus rubra - Carya ovalis / Acer saccharum / Polystichum acrostichoides Forest (CEGL007233) of the Cumberlands and southern Ridge and Valley.
Quercus alba - Quercus rubra - Carya ovata Glaciated Forest (CEGL002068)
Quercus alba - Quercus rubra - Quercus muehlenbergii / Cercis canadensis Forest (CEGL002070) is more circumneutral.
Quercus alba - Quercus velutina - Carya alba / Desmodium nudiflorum Ozark Forest (CEGL004270)
Quercus alba / Cornus florida Unglaciated Forest (CEGL002066)
Quercus falcata - Quercus alba - Quercus stellata - Quercus velutina Forest (CEGL005018)
Quercus velutina - Quercus alba - Carya (glabra, ovata) Forest (CEGL002076)
Global Related Concepts:
Dry-Mesic Acid (Chert, Igneous, Sandstone) forest (Nelson 1985) **?**
Dry-Mesic Chert Forest (Nelson 1985) **><**
Dry-Mesic Igneous Forest (Nelson 1985) **><**
Dry-Mesic Sandstone Forest (Nelson 1985) **><**
T1B4aIII. *Quercus rubra - Quercus* spp. (Foti et al. 1994) **?**

ELEMENT DISTRIBUTION

Buffalo National River Range: This common white oak - red oak forest was sampled near Buffalo Point (Indian Rockhouse Trail), Tyler Bend (Collier Homestead Historic Site), Kimball Bluff, McCutchen Gap at Point Peter Mountain, and along Chimney Rock Trail and Buffalo River Trail.
Global Range: This community is found in the Interior Highlands of the south-central United States, ranging from Arkansas and Missouri eastward to Tennessee, Kentucky, and southern Ohio.
Nations: US

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States/Provinces: AR, IL, IN, KY, MO, MS, OH, OK, TN, WV
TNC Ecoregions: 36:C, 38:C, 39:C, 43:C, 44:C, 48:C, 49:C
USFS Ecoregions (1994/95): 221Ea:CCC, 221Eb:CCC, 221Ec:CCC, 221Ed:CCC, 221Ee:CCC, 221Ef:CCC, 221Eg:CCC, 222Aa:CCC, 222Ab:CCC, 222Ac:CCC, 222Ad:CCC, 222Ae:CCC, 222Af:CCC, 222Ag:CCC, 222Ah:CCC, 222Aj:CCC, 222Ak:CCC, 222Am:CCC, 222An:CCC, 222Ao:CCC, 222Ap:CCC, 222Aq:CCP, 222Cg:CCC, 222Db:CCC, 222Dc:CCC, 222De:CCC, 222Df:CCC, 222Eg:CCC, 222Ei:CCC, 222Ek:CCC, 222Em:CCC, 222Fd:CCC, 222Fe:CCC, 222Ff:CCC, 231Bd:CCC, 231Be:CCC, 251Ce:CCC, M222Aa:CCC, M222Ab:CCC, M231A:CC
Federal Lands: NPS (Buffalo River, Natchez Trace, Shiloh); USFS (Ozark, Wayne)

ELEMENT SOURCES

Buffalo National River Plots: (19 plots): BUFF.054, BUFF.061, BUFF.062, BUFF.063, BUFF.072, BUFF.088, BUFF.092, BUFF.135, BUFF.136, BUFF.137, BUFF.138, BUFF.143, BUFF.144, BUFF.219, BUFF.725, BUFF.727, BUFF.728, BUFF.729, BUFF.744.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: D. Faber-Langendoen, mod. M. Pyne
References: Foti 1994b, Foti et al. 1994, Midwestern Ecology Working Group n.d., Nelson 1985, Parker 1989, TDNH unpubl. data

White Oak - Mixed Oak Dry-Mesic Alkaline Forest

***Quercus alba - Quercus rubra - Quercus muehlenbergii / Cercis canadensis* Forest**
White Oak - Northern Red Oak - Chinkapin Oak / Eastern Redbud Forest
Identifier: CEGL002070

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Southern Hardwood & Pine Forest (M016)
Group	South-Central Interior Oak Forest (G159)
Association (Common name)	White Oak - Mixed Oak Dry-Mesic Alkaline Forest

ELEMENT CONCEPT

Global Summary: This dry-mesic white oak - mixed oak alkaline forest community is found in unglaciated areas of the Interior Highlands of the east-central United States. Stands occur on gentle to steep slopes with moderately to well-drained moist loamy/sandy, relatively neutral to basic soils, which are underlain by bedrock of limestone and less commonly sandstone, siltstone, or shale. Soils may be shallow to somewhat deep (20-100 cm), with rock fragments present. The canopy is dense, yet enough scattered light penetrates to encourage a rich and diverse herbaceous layer, especially in the spring. Typical tree dominants include *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), and *Quercus muehlenbergii* (chinkapin oak). Typical associates include *Carya ovata* (shagbark hickory), *Carya alba* (mockernut hickory), and *Liriodendron tulipifera* (tuliptree). Other shade-tolerant tree associates that may dominate the subcanopy include *Acer saccharum* (sugar maple) (or possibly *Acer barbatum* (southern sugar maple) to the south), *Ulmus rubra* (slippery elm), *Juglans nigra* (black walnut), *Fraxinus americana* (white ash), *Ostrya virginiana* (hophornbeam), *Carpinus caroliniana* (American hornbeam), and *Amelanchier arborea* (common serviceberry). *Quercus muehlenbergii* (chinkapin oak) is a key, but perhaps uncommon, indicator of the more neutral to alkaline soil characteristics of this type. Typical shrubs include *Aesculus glabra* (Ohio buckeye), *Asimina triloba* (pawpaw), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Euonymus americanus* (bursting-heart), *Frangula caroliniana* (Carolina buckthorn), and *Viburnum rufidulum* (rusty blackhaw). Woody vines include *Parthenocissus quinquefolia* (Virginia creeper) and *Toxicodendron radicans* (eastern poison-ivy). Herbaceous species include *Anemone virginiana* (tall thimbleweed), *Arisaema triphyllum* (Jack in the pulpit), *Botrychium virginianum* (rattlesnake fern), *Carex jamesii* (James' sedge), *Actaea racemosa* (black baneberry), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Desmodium rotundifolium* (prostrate ticktrefoil), *Dioscorea quaternata* (fourleaf yam), *Goodyera pubescens* (downy rattlesnake plantain), *Hybanthus concolor* (eastern greenviolet), *Iris cristata* (dwarf crested iris), *Maianthemum racemosum* (feathery false lily of the valley), *Passiflora lutea* (yellow passionflower), and *Sanicula canadensis* (Canadian blacksnakeroot). These forests occur in habitats transitional between mesic to wet riparian and floodplain communities and the drier ridgetop ecosystems.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This common mixed oak forest was sampled at 18 locations in the park. Sites range from gently sloping to steep mid and lower slopes with mostly southern or northern aspects. Soils are typically dry-mesic rapidly to moderately well-drained clay loam, sandy loam, and silt loam. The unvegetated surface is typically dominated by leaf litter (15-98% cover), with some bedrock (0-30%), large rocks (0-30%), small rocks (0-30%), wood (0-5%), and bare soil (0-68%). Evidence of disturbance includes roads and trails, an old homesite, recent fires, erosion, and the presence of trash and exotic plants.
Global Environment: Stands occur on gentle to steep slopes with moderately to well-drained moist loamy/sandy, relatively neutral to basic soils, which are underlain by bedrock of limestone and less commonly sandstone, siltstone, or shale. Soils may be shallow to somewhat deep (20-100 cm), with rock fragments present. In Illinois, this community occurs on thin, sandy/loamy soils underlain by sedimentary rock (mostly Pennsylvanian age sandstone). Limestone and shale are commonly found where erosion has removed

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resistant sandstone layers near the surface (TNC 1995a). In Missouri, non-cherty limestones and dolomites prevail (Nelson 1985). In Alabama, this type occurs on mixed limestone and sandstone substrate, providing a subcalcareous substrate.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The sparse to very dense (20-80% cover) tree canopy, 10-35 m tall, is dominated by *Quercus alba* (white oak), *Quercus muehlenbergii* (chinkapin oak), and *Quercus rubra* (northern red oak), along with lesser amounts of other species that can include *Carya alba* (mockernut hickory), *Carya cordiformis* (bitternut hickory), *Carya ovata* (shagbark hickory), *Fraxinus americana* (white ash), *Juglans nigra* (black walnut), *Quercus shumardii* (Shumard oak), and *Quercus velutina* (black oak). The sparse to very dense (30-90%) subcanopy (10-20 m) is dominated by *Acer saccharum* (sugar maple), *Carya ovata* (shagbark hickory), Juniperus virginiana, Ostrya virginiana, and canopy oak species. The sparse to dense (20-80%) tall-shrub layer (2-5 m) and very sparse to moderate (10-40%) short-shrub layer (0.5-2 m) are made up of species from the upper layers as well as *Amelanchier arborea* (common serviceberry), *Asimina triloba* (pawpaw), *Celtis occidentalis* (common hackberry), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Diospyros virginiana* (common persimmon), *Frangula caroliniana* (Carolina buckthorn), *Fraxinus quadrangulata* (blue ash), *Juniperus virginiana* (eastern red-cedar), *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), *Sideroxylon lanuginosum* (gum bully), *Ulmus alata* (winged elm), and *Viburnum rufidulum* (rusty blackhaw). Depending on the density of the upper layers, the herbaceous layer may be very sparse to very dense (10-90%). Common species include *Agrimonia rostellata* (beaked agrimony), *Amphicarpaea bracteata* (American hogpeanut), *Aristolochia serpentaria* (Virginia snakeroot), *Asplenium platyneuron* (ebony spleenwort), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Dichanthelium boscii* (Bosc's panicgrass), *Dioscorea villosa* (wild yam), *Galium circaezans* (licorice bedstraw), *Galium circaezans* (licorice bedstraw), and *Thalictrum thalictroides* (rue-anemone). Common and abundant vines include *Vitis aestivalis* (summer grape), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax bona-nox* (saw greenbrier), and *Toxicodendron radicans* (eastern poison-ivy). In addition, this community supports state-imperiled *Carex hitchcockiana* (Hitchcock's sedge), *Carex mesochorea* (midland sedge), and globally and state-vulnerable *Delphinium newtonianum* (Newton's larkspur), *Tradescantia ozarkana* (Ozark spiderwort), and *Trillium pusillum var. ozarkanum* (Ozark wakerobin).

Global Vegetation: The canopy is dense, yet enough scattered light penetrates to encourage a rich and diverse herbaceous layer. Typical tree dominants include *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), and *Quercus muehlenbergii* (chinkapin oak). Typical associates include *Carya ovata* (shagbark hickory) and *Carya alba* (mockernut hickory). Other shade-tolerant tree associates that may dominate the subcanopy include *Acer saccharum* (sugar maple) (and/or *Acer barbatum* (southern sugar maple) or *Acer leucoderme* (chalk maple) to the south), *Ulmus rubra* (slippery elm), *Juglans nigra* (black walnut), *Fraxinus americana* (white ash), *Ostrya virginiana* (hophornbeam), *Carpinus caroliniana* (American hornbeam), and *Amelanchier arborea* (common serviceberry). *Quercus muehlenbergii* (chinkapin oak) is a key, but perhaps uncommon, indicator of the more neutral to alkaline soil characteristics of this type. *Juniperus virginiana* (eastern red-cedar) may be present. Typical shrubs include *Aesculus glabra* (Ohio buckeye), *Asimina triloba* (pawpaw), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Euonymus americanus* (bursting-heart), *Frangula caroliniana* (Carolina buckthorn), and *Viburnum rufidulum* (rusty blackhaw). Woody vines include *Parthenocissus quinquefolia* (Virginia creeper) and *Toxicodendron radicans* (eastern poison-ivy). Herbaceous species include *Anemone virginiana* (tall thimbleweed), *Arisaema triphyllum* (Jack in the pulpit), *Botrychium virginianum* (rattlesnake fern), *Carex jamesii* (James' sedge), *Actaea racemosa* (black baneberry), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Desmodium rotundifolium* (prostrate ticktrefoil), *Dioscorea quaternata* (fourleaf yam), *Goodyera pubescens* (downy rattlesnake plantain), *Hybanthus concolor* (eastern greenviolet), *Iris cristata* (dwarf crested iris), *Maianthemum racemosum* (feathery false lily of the valley), *Passiflora lutea* (yellow passionflower), and *Sanicula canadensis* (Canadian blacksnakeroot). These forests occur in habitats transitional between mesic to wet riparian and floodplain communities and the drier ridgetop ecosystems (Nelson 1985, TNC 1995a).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Carya ovata* (shagbark hickory), *Quercus alba* (white oak), *Quercus muehlenbergii* (chinkapin oak), *Quercus rubra* (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Asimina triloba* (pawpaw), *Cercis canadensis* (eastern redbud)
Tall shrub/sapling	Needle-leaved shrub	*Juniperus virginiana* (eastern red-cedar)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer saccharum* (sugar maple), *Cornus florida* (flowering dogwood), *Ostrya virginiana* (hophornbeam)
Short shrub/sapling	Broad-leaved deciduous shrub	*Fraxinus americana* (white ash)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper)
Herb (field)	Forb	*Amphicarpaea bracteata* (American hogpeanut), *Toxicodendron radicans* (eastern poison-ivy)

Global

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Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus alba* (white oak), *Quercus muehlenbergii* (chinkapin oak), *Quercus rubra* (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Shrub/sapling (tall & short)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper), *Smilax bona-nox* (saw greenbrier), *Toxicodendron radicans* (eastern poison-ivy)
Herb (field)	Forb	*Arisaema dracontium* (green dragon), *Hybanthus concolor* (eastern greenviolet)
Herb (field)	Graminoid	*Carex jamesii* (James' sedge)

CHARACTERISTIC SPECIES

Buffalo National River: *Acer saccharum* (sugar maple), *Amphicarpaea bracteata* (American hogpeanut), *Asimina triloba* (pawpaw), *Carya ovata* (shagbark hickory), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Fraxinus americana* (white ash), *Juniperus virginiana* (eastern red-cedar), *Ostrya virginiana* (hophornbeam), *Parthenocissus quinquefolia* (Virginia creeper), *Quercus alba* (white oak), *Quercus muehlenbergii* (chinkapin oak), *Quercus rubra* (northern red oak), *Toxicodendron radicans* (eastern poison-ivy)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Carex hitchcockiana* (Hitchcock's sedge, state-imperiled, G5), *Carex mesochorea* (midland sedge, state-imperiled, G4G5), *Delphinium newtonianum* (Newton's larkspur, globally and state-vulnerable, G3), *Tradescantia ozarkana* (Ozark spiderwort, globally and state-vulnerable, G3), *Trillium pusillum* var. *ozarkanum* (Ozark wakerobin, globally and state-vulnerable, G3T3), *Viburnum molle* (softleaf arrowwood, state-critically imperiled, G5); **Exotic/Invasive**: *Ipomoea coccinea* (redstar, exotic), *Leucanthemum vulgare* (oxeye daisy, exotic, Medium/Low), *Lonicera japonica* (Japanese honeysuckle, exotic, High/Medium), *Poa pratensis* (Kentucky bluegrass, exotic, Medium), *Rosa multiflora* (multiflora rose, exotic, Medium/Low)
Global: Vulnerable: *Myotis sodalis* (indiana myotis, State listed endangered; often utilize shagbark hickory as roost sites (TNC 1995)., G2); **Other**: *Agkistrodon contortrix* (copperhead, G5), *Callirhytis quercuspunctata* (gouty oak gall wasp, GNR), *Caprimulgus vociferus* (whip-poor-will, G5), *Chionaspis corni* (dogwood scale, GNR), *Cyanocitta cristata* (blue jay, G5), *Dendroica cerulea* (cerulean warbler, G4), *Dryocopus pileatus* (pileated woodpecker, G5), *Eurytides marcellus* (zebra swallowtail, G5), *Glaucomys volans* (southern flying squirrel, G5), *Hylocichla mustelina* (wood thrush, G5), *Lynx rufus* (bobcat, State threatened in Illinois (TNC 1995)., G5), *Melanerpes carolinus* (red-bellied woodpecker, G5), *Melanerpes erythrocephalus* (red-headed woodpecker, G5), *Meleagris gallopavo* (wild turkey, G5), *Nymphalis antiopa* (mourning cloak, G5), *Odocoileus virginianus* (white-tailed deer, G5), *Piranga olivacea* (scarlet tanager, G5), *Plestiodon laticeps* (broad-headed skink, G5), *Sayornis phoebe* (eastern phoebe, G5), *Schizura badia* (chestnut schizura, G5), *Sciurus carolinensis* (eastern gray squirrel, G5), *Sciurus niger* (eastern fox squirrel, G5), *Tamias striatus* (eastern chipmunk, G5), *Thryothorus ludovicianus* (carolina wren, G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (22-Jun-1998).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: The concept of this type relies, in part, on Missouri's "dry-mesic limestone/dolomite forest" (Nelson 1985). Stands in Illinois and Indiana may not have strongly contrasting alkaline and acidic rocks compared to those in the Ozarks. This type may also occur in the south-central glaciated portion of Illinois. Examples from Arkansas may lack *Quercus rubra* (northern red oak). Neither *Quercus muehlenbergii* (chinkapin oak) nor *Cercis canadensis* (eastern redbud) may be very common in this type. Extensive selective logging of *Quercus alba* (white oak) and *Quercus rubra* (northern red oak) for sawtimber has severely impacted this community. Stands placed in this type in northern Alabama (Bankhead National Forest) and the Nashville Basin of Tennessee are not a perfect match, but seem similar enough to classify here. The range of this originally Ozarkian type has been expanded to include much of the unglaciated Interior Low Plateau; there may be substantial differences among examples across this range to warrant subdivision, but this has not been tested through any kind of analysis.
Global Similar Associations:
Fagus grandifolia - Quercus alba / Cornus florida Forest (CEGL007881) contains a high concentration of *Fagus grandifolia* in the canopy.
Quercus alba - Carya alba - (Quercus velutina) / Desmodium nudiflorum - (Carex picta) Forest (CEGL007795) is not as strongly calcareous in character but with a similar distribution.
Quercus alba - Quercus rubra - Carya (alba, ovata) / Cornus florida Acidic Forest (CEGL002067) is very similar, but has a more acidic character.
Quercus alba - Quercus rubra - Carya ovata / Cercis canadensis - Juniperus virginiana var. virginiana Forest (CEGL007240)
Quercus alba - Quercus rubra - Carya ovata Glaciated Forest (CEGL002068)
Quercus alba - Quercus stellata / Ostrya virginiana - Acer barbatum / Chasmanthium sessiliflorum Forest (CEGL008443)
Quercus alba - Quercus velutina - Carya alba / Desmodium nudiflorum Ozark Forest (CEGL004270)
Quercus alba / Cornus florida Unglaciated Forest (CEGL002066)

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Quercus falcata - Quercus alba - Quercus stellata - Quercus velutina Forest (CEGL005018) occurs on drier sites and contains *Quercus falcata*, which this community does not have in large amounts.
Quercus muehlenbergii - Quercus shumardii - Carya (carolinae-septentrionalis, ovata) Forest (CEGL007808)
Quercus prinus - Quercus rubra - Carya spp. - *Fraxinus americana / Cercis canadensis / Solidago sphacelata* Forest (CEGL008549)
Quercus rubra / Ostrya virginiana / Ptelea trifoliata - Ribes curvatum / Helianthus divaricatus Woodland (CEGL007828)
Quercus velutina - Quercus alba - Carya (glabra, ovata) Forest (CEGL002076) occurs where soils are drier and thick to very thin over bedrock which is often exposed, and on hillsides with clay soils where sand is absent.

Global Related Concepts:
Quercus rubra - Quercus alba mesic lower slope community type (Robertson et al. 1984) =
Dry-Mesic Limestone/Dolomite Forest (Nelson 1985) >
Eastern Broadleaf Forests: 100: Oak-Hickory Forest (*Quercus-Carya*) (Kuchler 1964) >
Northern Red Oak: 55 (Eyre 1980) >
Terrestrial: Forest: Hardwood (TNC 1985) >
UNESCO FORMATION CODE: I.B.3a (UNESCO 1973) >
White Oak - Black Oak - Northern Red Oak: 52 (Eyre 1980) >
White Oak: 53 (Eyre 1980) >

ELEMENT DISTRIBUTION

Buffalo National River Range: This mixed oak forest was sampled along Boxley Trail, Buffalo River Trail, Indian Rockhouse Trail, Monte Cristo Trail, and near Hathaway Horse Camp in Wilderness Turkey Mountain, Tyler Bend, and Gene Rush Wildlife Management Area.
Global Range: This forest community is found in calcareous regions of the Interior Highlands of the east-central United States, ranging from Missouri and Arkansas east to Indiana, south to Kentucky, Tennessee and northern Alabama, and possibly in Oklahoma.
Nations: US
States/Provinces: AL, AR, IL, IN, KY, MO:S3, MS, OK?, TN
TNC Ecoregions: 36:C, 37:C, 38:C, 39:C, 43:C, 44:C, 48:C, 50:C
USFS Ecoregions (1994/95): 221Hc:CCC, 222Aa:CCC, 222Ab:CCC, 222Ac:CCC, 222Ae:CCP, 222Af:CC?, 222Ag:CCC, 222Ak:CCC, 222Am:CCC, 222An:CCC, 222Ao:CCC, 222Aq:CCC, 222Ch:CCC, 222De:CC?, 222Df:CCC, 222Dg:CCC, 222Dh:CCC, 222Di:CCC, 222Ec:CCC, 222Ed:CCC, 222Eg:CCC, 222Ej:CCP, 222Ek:CCC, 222Em:CCP, 222Eo:CCC, 222Fa:CCP, 222Fb:CCC, 222Fe:CCC, 231Bd:CCC, 231Be:CCC, 231Bk:CCC, 231Cd:CCC, 231Gb:CCC, 251Cd:CCC, 251Ce:CCC, 251Ea:CCC, M222Aa:CCC, M222Ab:CCC
Federal Lands: NPS (Abe Lincoln Birthplace, Buffalo River, Fort Donelson, Mammoth Cave, Natchez Trace, Ozark Riverways, Russell Cave, Shiloh); USFS (Bankhead, Daniel Boone, Mark Twain, Ouachita (Mountains)?, Ouachita?, Ozark, Shawnee, Talladega, Talladega (Talladega))

ELEMENT SOURCES

Buffalo National River Plots: (18 plots): BUFF.010, BUFF.012, BUFF.014, BUFF.017, BUFF.020, BUFF.022, BUFF.025, BUFF.034, BUFF.037, BUFF.038, BUFF.043,BUFF.100, BUFF.160, BUFF.163, BUFF.171, BUFF.203, BUFF.737, BUFF.757.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: M. Guetersloh, mod. M. Pyne and D. Faber-Langendoen
References: Chastain et al. 2006, Evans 1991, Eyre 1980, Fralish 1987, Fralish et al. 1991, Kuchler 1964, Midwestern Ecology Working Group n.d., NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1985, Nigh et al. 2000, Robertson and Heikens 1994, Robertson et al. 1984, Schotz pers. comm., TDNH unpubl. data, TNC 1985, TNC 1995a, UNESCO 1973, Voigt and Mohlenbrock 1964, White and Madany 1978

White Oak - Post Oak / Bluestem Ozark Woodland

***Quercus alba - Quercus stellata - Quercus velutina / Schizachyrium scoparium* Woodland**
White Oak - Post Oak - Black Oak / Little Bluestem Woodland
Identifier: CEGL002150

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Southern Hardwood & Pine Forest (M016)
Group	South-Central Interior Oak Forest (G159)
Association (Common name)	White Oak - Post Oak / Bluestem Ozark Woodland

ELEMENT CONCEPT

Global Summary: This white oak - post oak woodland community is found in the Ozarks and adjacent regions of the United States. Stands occur on gentle to steep hills, plains, ridges, and flats of all aspects. The soils are well- to very rapidly drained, and very shallow to deep (0-100 cm). The parent material is chert, sandstone, or igneous with areas of bedrock or rock residuum present at the surface. This woodland community has 20-60% tree canopy cover, which is short to medium in height (7-20 m) and dominated by species such as *Crataegus* (hawthorn) spp., *Pinus echinata* (shortleaf pine), *Quercus alba* (white oak), *Quercus marilandica*

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(blackjack oak), *Quercus stellata* (post oak), and *Quercus velutina* (black oak). The trees are often limby or shrubby in areas of sparse cover where bedrock is exposed. When an understory is present it is variable, consisting of a mosaic of scattered shrubs or groups of small trees. Shrubs include *Rhus aromatica* (fragrant sumac), *Vaccinium arboreum* (farkleberry), and *Vaccinium pallidum* (Blue Ridge blueberry). The ground cover is dominated by grasses such as *Andropogon gerardii* (big bluestem), *Schizachyrium scoparium* (little bluestem), and *Sorghastrum nutans* (Indiangrass), with sparse to mixed forbs. Mosses and lichens are often present.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This white oak - post oak woodland was sampled at 11 locations in the park. Sites range from gentle to steep, mid to upper slopes, ridges, and bedrock outcrops of any aspect. Soils are xeric to dry-mesic and range from rapidly drained to moderately well-drained clay loam, sandy loam, silt loam, and clay. The unvegetated surface is made up of leaf litter (20-98% cover), bedrock (0-45%), large rocks (0-10%), small rocks (0-10%), wood (0-2%), and bare soil (0-55%). Evidence of disturbance includes past fire (some intense), trails, heavy frost damage, and the presence of exotic plants.

Global Environment: This community occurs on gentle to steep hills, plains, ridges, and flats of all aspects. The soils are well- to very rapidly drained, and very shallow to deep (0-100 cm). The parent material is chert, sandstone, or, rarely, igneous with areas of bedrock or rock residuum present at the surface.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The sparse (5-40% cover), structurally variable tree canopy, 5-35 m tall, is dominated by *Quercus alba* (white oak), *Quercus stellata* (post oak), and *Quercus velutina* (black oak) and may also include *Carya alba* (mockernut hickory) and *Carya texana* (black hickory), among others. There may be a sparse (20-40%) subcanopy (5-15 m) or it may be absent. When present, it generally has the same make up as the canopy. The very sparse to dense (5-80%) tall-shrub layer (2-5 m) and very sparse to moderate (5-60%) short-shrub layer (0.5-1 m) include canopy species as well as *Amelanchier arborea* (common serviceberry), *Celtis tenuifolia* (dwarf hackberry), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Diospyros virginiana* (common persimmon), *Frangula caroliniana* (Carolina buckthorn), *Fraxinus americana* (white ash), *Juniperus virginiana* (eastern red-cedar), *Ostrya virginiana* (hophornbeam), *Prunus serotina* (black cherry), *Quercus muehlenbergii* (chinkapin oak), *Rhus aromatica* (fragrant sumac), *Sassafras albidum* (sassafras), *Sideroxylon lanuginosum* (gum bully), *Ulmus alata* (winged elm), and *Viburnum rufidulum* (rusty blackhaw). Common species in the herbaceous layer (5-50%) include *Amphicarpaea bracteata* (American hogpeanut), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Desmodium perplexum* (perplexed ticktrefoil), *Desmodium rotundifolium* (prostrate ticktrefoil), *Dichanthelium boscii* (Bosc's panicgrass), *Euphorbia corollata* (flowering spurge), *Helianthus divaricatus* (woodland sunflower), *Passiflora lutea* (yellow passionflower), *Solidago ulmifolia* (elmleaf goldenrod), *Symphyotrichum anomalum* (manyray aster), and *Symphyotrichum patens* (late purple aster). Vines (up to 10%) include *Parthenocissus quinquefolia* (Virginia creeper), *Smilax bona-nox* (saw greenbrier), *Toxicodendron radicans* (eastern poison-ivy), *Vitis aestivalis* (summer grape), and *Vitis vulpina* (frost grape).

Global Vegetation: This woodland community has 20-60% tree canopy cover, 7-20 m tall, and dominated by tree species such as *Crataegus* (hawthorn) spp., *Pinus echinata* (shortleaf pine), *Quercus alba* (white oak), *Quercus marilandica* (blackjack oak), *Quercus stellata* (post oak), and *Quercus velutina* (black oak). The trees are often limby or shrubby in areas of sparse cover where bedrock is exposed. When an understory is present it is variable, consisting of a mosaic of scattered shrubs or groups of small trees. Shrubs include *Rhus aromatica* (fragrant sumac), *Vaccinium arboreum* (farkleberry), and *Vaccinium pallidum* (Blue Ridge blueberry). The ground cover is dominated by grasses such as *Andropogon gerardii* (big bluestem), *Schizachyrium scoparium* (little bluestem) and *Sorghastrum nutans* (Indiangrass), with sparse to mixed forbs. Mosses and lichens are often present.

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Quercus alba* (white oak), *Quercus stellata* (post oak), *Quercus velutina* (black oak)
Tree subcanopy	Broad-leaved deciduous tree	*Carya alba* (mockernut hickory), *Carya texana* (black hickory)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Ostrya virginiana* (hophornbeam)
Tall shrub/sapling	Needle-leaved shrub	*Juniperus virginiana* (eastern red-cedar)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Fraxinus americana* (white ash), *Ulmus alata* (winged elm)
Short shrub/sapling	Broad-leaved deciduous shrub	*Rhus aromatica* (fragrant sumac)
Herb (field)	Forb	*Toxicodendron radicans* (eastern poison-ivy)

Global

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus echinata* (shortleaf pine)
Tree canopy	Broad-leaved deciduous tree	*Quercus alba* (white oak), *Quercus marilandica* (blackjack oak), *Quercus stellata* (post oak), *Quercus velutina* (black oak)
Short shrub/sapling	Broad-leaved evergreen tree	*Vaccinium arboreum* (farkleberry)

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Short shrub/sapling	Broad-leaved deciduous shrub	*Rhus aromatica* (fragrant sumac), *Vaccinium pallidum* (Blue Ridge blueberry)
Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem), *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass)

CHARACTERISTIC SPECIES

Buffalo National River: *Amelanchier arborea* (common serviceberry), *Carya alba* (mockernut hickory), *Carya texana* (black hickory), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Desmodium rotundifolium* (prostrate ticktrefoil), *Frangula caroliniana* (Carolina buckthorn), *Fraxinus americana* (white ash), *Juniperus virginiana* (eastern red-cedar), *Ostrya virginiana* (hophornbeam), *Parthenocissus quinquefolia* (Virginia creeper), *Quercus alba* (white oak), *Quercus stellata* (post oak), *Quercus velutina* (black oak), *Rhus aromatica* (fragrant sumac), *Symphyotrichum patens* (late purple aster), *Toxicodendron radicans* (eastern poison-ivy), *Ulmus alata* (winged elm)
Global: *Quercus alba* (white oak), *Quercus stellata* (post oak), *Quercus velutina* (black oak), *Schizachyrium scoparium* (little bluestem)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Exotic/Invasive: *Lespedeza cuneata* (sericea lespedeza, exotic, Medium), *Melilotus officinalis* (yellow sweetclover, exotic, Medium/Low), *Taraxacum officinale* (common dandelion, exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (22-Jun-1998). Only a few occurrences of this community are known. Most of the original sites have been destroyed by logging, grazing, conversion to forest because of fire suppression, or invasion by exotic species.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: Only a few occurrences of this community are known. Most of the original sites have been destroyed by logging, grazing, conversion to forest because of fire suppression, or invasion by exotic species. This community is associated with glades, cliffs, and dry forests in southeastern Missouri. *Quercus stellata - Quercus marilandica - Quercus velutina - Carya texana / Schizachyrium scoparium* Woodland (CEGL002149) is similar to this type but drier; however, in Missouri they may be similar enough to combine (M. Leahy pers. comm. 1999). This type could also be in Illinois as the woodland form of the dry-mesic barren type *Quercus stellata - Quercus alba - (Quercus falcata) / Schizachyrium scoparium* Woodland (CEGL004217).
Global Similar Associations:
Juniperus virginiana - Quercus (alba, stellata) - Carya texana Forest (CEGL004803)
Quercus stellata - Quercus alba - (Quercus falcata) / Schizachyrium scoparium Woodland (CEGL004217)
Quercus stellata - Quercus marilandica - Quercus velutina - Carya texana / Schizachyrium scoparium Woodland (CEGL002149)
Quercus stellata - Quercus velutina / Schizachyrium scoparium Woodland (CEGL005281)
Quercus velutina - Quercus alba - Carya (glabra, ovata) Forest (CEGL002076)
Global Related Concepts:
Dry-Mesic Savanna (Nelson 1985) >

ELEMENT DISTRIBUTION

Buffalo National River Range: This white oak - post oak woodland was sampled near Kimball Bluff, Buffalo Point, Tyler Bend, Maumee South, and along Buffalo River Trail.
Global Range: This white oak - post oak woodland community is found in the Ozark region of the United States, particularly in Missouri and Arkansas.
Nations: US
States/Provinces: AR, IL, IN, MO
TNC Ecoregions: 37:C, 38:C, 39:C, 44:C
USFS Ecoregions (1994/95): 222Ab:CC?, 222Ag:CCC, 222Aj:CCP, 222Am:CC?, 222An:CCC, 222Ao:CCP, 222Aq:CC?, 222De:CPP, 222Di:CPP, 222Gb:CCC, 231Gb:CCC, 251:?, M222Aa:CCC
Federal Lands: NPS (Buffalo River); USFS (Ouachita, Ouachita (Mountains), Ozark, Shawnee)

ELEMENT SOURCES

Buffalo National River Plots: (11 plots): BUFF.036, BUFF.071, BUFF.109, BUFF.131, BUFF.161, BUFF.185, BUFF.196, BUFF.717, BUFF.720, BUFF.721, BUFF.741.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: J. Drake, D. Faber-Langendoen, and D. Ambrose
References: Leahy pers. comm., Midwestern Ecology Working Group n.d., Nelson 1985

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Ozark-Ouachita Dry-Mesic - White Oak - Black Oak - Hickory Forest

***Quercus alba - Quercus velutina - Carya alba / Desmodium nudiflorum* Ozark Forest**
White Oak - Black Oak - Mockernut Hickory / Naked-flower Tick-trefoil Ozark Forest
Identifier: CEGL004270

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Southern Hardwood & Pine Forest (M016)
Group	South-Central Interior Oak Forest (G159)
Association (Common name)	Ozark-Ouachita Dry-Mesic - White Oak - Black Oak - Hickory Forest

ELEMENT CONCEPT

Global Summary: This dry-mesic white oak - hickory forest is found in the Ozark and Ouachita ecoregions of Arkansas and possibly Oklahoma and Missouri. Stands occur in dissected landscapes at moderate elevations (200-550 m [600-1800 feet]), on mid to higher slopes of various aspects, as well as toeslopes of gently convex form. Examples on different aspects vary somewhat in expression; however, the canopy is typically dominated by *Quercus alba* (white oak), *Quercus velutina* (black oak), and *Carya alba* (mockernut hickory). *Carya glabra* (pignut hickory) is common and *Quercus rubra* (northern red oak) may be found in some examples, particularly on north- and east-facing slopes. The subcanopy may also contain *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Amelanchier arborea* (common serviceberry), and *Nyssa sylvatica* (blackgum). *Acer rubrum* (red maple), *Cornus florida* (flowering dogwood), *Ostrya virginiana* (hophornbeam), and *Vaccinium stamineum* (deerberry) may be prominent low shrubs. The herb layer composition may be quite variable depending on aspect, but it is typically dominated by *Amphicarpaea bracteata* (American hogpeanut), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dichanthelium boscii* (Bosc's panicgrass), *Monarda bradburiana* (eastern beebalm), *Parthenocissus quinquefolia* (Virginia creeper), and/or *Toxicodendron radicans* (eastern poison-ivy).

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This white oak - hickory forest was sampled at 10 locations in the park. Sites range from gentle to somewhat steep mid and upper slopes with mostly northern and eastern aspects. Soils are generally dry-mesic moderately well-drained clay loam, sandy loam and silt loam. The unvegetated surface is dominated by leaf litter (92-99% cover), with some large rocks (0-4%) and wood (1-3%). Evidence of disturbance includes past thinning and burning and the presence of roads and trails.
Global Environment: Stands occur in dissected landscapes at moderate elevations (200-550 m [600-1800 feet]), on mid to higher slopes of various aspects, as well as toeslopes of gently convex form. Aspect may be an important factor in species composition of different stands attributable to this type.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The sparse to very dense (30-90% cover) tree canopy, 15-35 m tall, is dominated by *Carya alba* (mockernut hickory), *Quercus alba* (white oak), and *Quercus velutina* (black oak). The sparse to moderately dense (30-70%) subcanopy (10-20 m) is dominated by the same species. The very sparse to moderate (5-60%) tall-shrub layer (2-10 m) and very sparse to moderate (5-50%) short-shrub layer (0.5-1 m) are made up of canopy tree saplings along with *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Fraxinus americana* (white ash), *Nyssa sylvatica* (blackgum), *Ostrya virginiana* (hophornbeam), *Sassafras albidum* (sassafras), *Ulmus alata* (winged elm), *Vaccinium stamineum* (deerberry), and *Viburnum rufidulum* (rusty blackhaw). The very sparse to dense (5-80%) herbaceous layer may be dominated by *Amphicarpaea bracteata* (American hogpeanut), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dichanthelium boscii* (Bosc's panicgrass), *Monarda bradburiana* (eastern beebalm), *Parthenocissus quinquefolia* (Virginia creeper), and/or *Toxicodendron radicans* (eastern poison-ivy); other common species include *Cynoglossum virginianum* (wild comfrey), *Danthonia spicata* (poverty oatgrass), *Dioscorea villosa* (wild yam), *Galium circaezans* (licorice bedstraw), *Smilax* (greenbrier) spp., *Viola* (violet) spp., and *Vitis* (grape) spp. This community also supports state-critically imperiled *Viburnum molle* (softleaf arrowwood), and globally and state-vulnerable *Castanea pumila var. ozarkensis* (Ozark chinkapin), *Delphinium newtonianum* (Newton's larkspur), and *Trillium pusillum var. ozarkanum* (Ozark wakerobin).
Global Vegetation: The canopy is typically dominated by *Quercus alba* (white oak), *Quercus velutina* (black oak), and *Carya alba* (mockernut hickory). *Carya glabra* (pignut hickory) is common and *Quercus rubra* (northern red oak) may be found in some examples, particularly on north- and east-facing slopes. The subcanopy may also contain *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Amelanchier arborea* (common serviceberry), and *Nyssa sylvatica* (blackgum). *Acer rubrum* (red maple), *Cornus florida* (flowering dogwood), *Ostrya virginiana* (hophornbeam), and *Vaccinium stamineum* (deerberry) may be prominent low shrubs. The herb layer composition may be quite variable depending on aspect, but it is typically dominated by *Amphicarpaea bracteata* (American hogpeanut), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dichanthelium boscii* (Bosc's panicgrass), *Monarda bradburiana* (eastern beebalm), *Parthenocissus quinquefolia* (Virginia creeper), and/or *Toxicodendron radicans* (eastern poison-ivy).

MOST ABUNDANT SPECIES

Buffalo National River

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Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Carya alba* (mockernut hickory), *Quercus alba* (white oak), *Quercus velutina* (black oak)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer saccharum* (sugar maple), *Cornus florida* (flowering dogwood), *Nyssa sylvatica* (blackgum), *Sassafras albidum* (sassafras)
Short shrub/sapling	Broad-leaved deciduous shrub	*Fraxinus americana* (white ash), *Vaccinium stamineum* (deerberry)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper)
Herb (field)	Forb	*Amphicarpaea bracteata* (American hogpeanut), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Toxicodendron radicans* (eastern poison-ivy)
Herb (field)	Graminoid	*Dichanthelium boscii* (Bosc's panicgrass)

CHARACTERISTIC SPECIES

Buffalo National River: *Acer saccharum* (sugar maple), *Amphicarpaea bracteata* (American hogpeanut), *Carya alba* (mockernut hickory), *Cornus florida* (flowering dogwood), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dichanthelium boscii* (Bosc's panicgrass), *Fraxinus americana* (white ash), *Nyssa sylvatica* (blackgum), *Parthenocissus quinquefolia* (Virginia creeper), *Quercus alba* (white oak), *Quercus velutina* (black oak), *Sassafras albidum* (sassafras), *Toxicodendron radicans* (eastern poison-ivy), *Vaccinium stamineum* (deerberry)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Castanea pumila* var. *ozarkensis* (Ozark chinkapin, globally and state-vulnerable, G5T3), *Delphinium newtonianum* (Newton's larkspur, globally and state-vulnerable, G3), *Trillium pusillum* var. *ozarkanum* (Ozark wakerobin, globally and state-vulnerable, G3T3), *Viburnum molle* (softleaf arrowwood, state-critically imperiled, G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (15-Sep-2008). This is not an inherently rare forest type, and many examples are still extant. The lack of element occurrences of this type does not reflect its relative abundance. It is an extensive and widespread forest type within its range. This type is described from the Ozark Plateau of Arkansas. Some stands have been impacted by removal of more valuable timber species (e.g., *Quercus alba* (white oak)). There may be some loss of herbaceous species diversity from the disturbance effects of logging.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Buffalo National River Comments: This association was developed as an Ozarkian analogue to *Quercus alba - Carya alba - (Quercus velutina) / Desmodium nudiflorum - (Carex picta)* Forest (CEGL007795) of the Interior Low Plateau. Most black oak-dominated stands in the Ozarks are classified as *Quercus velutina - Quercus alba - Carya (glabra, ovata)* Forest (CEGL002076) [see the global classification comments for that association]. However, that association as described has a dry to dry-mesic moisture regime with rather stunted trees and should be a woodland. This association is dry-mesic to mesic in character with large trees and is a forest. That is the character of the plots that are assigned here. They are not woodlands, even fire-suppressed woodlands. The ILP association (CEGL007795) should be reserved for eastern forests and this new association for black oak-dominated forests (CEGL004270) has been defined for the Ozarks.

Global Comments: This type was developed as an Ozarkian analogue to *Quercus alba - Carya alba - (Quercus velutina) / Desmodium nudiflorum - (Carex picta)* Forest (CEGL007795) of the Interior Low Plateau. In Illinois and Indiana this type may overlap in concept with *Quercus alba / Cornus florida* Unglaciated Forest (CEGL002066); this relationship should be reviewed. Alternatively, there may be some overlap with unglaciated Ozarkian stands placed in *Quercus velutina - Quercus alba - Carya (glabra, ovata)* Forest (CEGL002076). However, CEGL002076 is described as dry to dry-mesic, with trees often spreading and stunted, whereas sites of this association are dry-mesic to mesic, and trees are not stunted. Overstory associates of CEGL002776 include *Quercus coccinea* (scarlet oak), *Quercus prinus* (chestnut oak), and *Quercus stellata* (post oak), none of which are common in this type.

Global Similar Associations:

Quercus alba - (Quercus velutina) - Carya ovata / Ostrya virginiana Forest (CEGL002011) is similar but with a more northwesterly distribution.

Quercus alba - Carya alba - (Quercus velutina) / Desmodium nudiflorum - (Carex picta) Forest (CEGL007795) is a similar type of the Interior Low Plateau.

Quercus alba - Quercus rubra - Carya (alba, ovata) / Cornus florida Acidic Forest (CEGL002067)

Quercus alba - Quercus rubra - Quercus muehlenbergii / Cercis canadensis Forest (CEGL002070) is a type with a more strongly alkaline character.

Quercus alba / Cornus florida Unglaciated Forest (CEGL002066)

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Quercus velutina - Quercus alba - Carya (glabra, ovata) Forest (CEGL002076) is at least locally a drier type than CEGL004270 (see above).

ELEMENT DISTRIBUTION

Buffalo National River Range: This white oak - hickory forest was sampled along Buffalo River Trail, Chimney Rock Trail, near Buffalo Point, Rush, Maumee South, Point Peter Mountain, along Erbie Campground Road, and above Ludlow Bluff at Seven-mile Bend in Lower Buffalo Wilderness.
Global Range: This association is found in the Ozark and Ouachita ecoregions of Arkansas and possibly Oklahoma and Missouri.
Nations: US
States/Provinces: AR, MO?, OK?
TNC Ecoregions: 38:C, 39:?
Federal Lands: NPS (Buffalo River, Ozark Riverways?); USFS (Mark Twain?, Ozark?)

ELEMENT SOURCES

Buffalo National River Plots: (10 plots): BUFF.019, BUFF.052, BUFF.067, BUFF.087, BUFF.195, BUFF.212, BUFF.710, BUFF.730, BUFF.733, BUFF.801.
Local Description Authors: M.J. Russo, mod. T. Foti
Global Description Authors: M. Pyne and T. Foti
References: Foti pers. comm., NatureServe Ecology - Southeastern U.S. unpubl. data, Southeastern Ecology Working Group n.d.

Eastern Oklahoma Dry-Mesic Oak - Hickory Forest

***Quercus falcata - Carya alba - Carya ovata* Forest**
Southern Red Oak - Mockernut Hickory - Shagbark Hickory Forest
Identifier: CEGL004543

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Southern Hardwood & Pine Forest (M016)
Group	South-Central Interior Oak Forest (G159)
Association (Common name)	Eastern Oklahoma Dry-Mesic Oak - Hickory Forest

ELEMENT CONCEPT

Global Summary: This oak-hickory forest is known from mesic to dry-mesic valleys and uplands of eastern Oklahoma (Adair, Cherokee, Choctaw, Haskell, Latimer, LeFlore, McCurtain, and Pushmataha counties), ranging into the Arkansas Ozarks. The canopy contains a mixture of *Quercus falcata* (southern red oak), *Carya alba* (mockernut hickory), and *Carya ovata* (shagbark hickory). Other characteristic species include *Quercus velutina* (black oak).

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This dry-mesic oak - hickory forest was sampled at five locations in the park. Sites are on moderate to somewhat steep lower to upper slopes with eastern aspects. Soils are dry-mesic, well-drained clay loam, silt loam and loam. The unvegetated surface is made up of leaf litter (55-97% cover), with some large rocks (0-10%), small rocks (0-5%), wood (0-45%), and bare soil (0-1%). Evidence of disturbance includes the presence of roads/trails and exotic plants.
Global Environment: This forest is known from mesic to dry-mesic valleys and uplands of eastern Oklahoma.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The moderate to very dense (50-90% cover) tree canopy, 15-35 m tall, and sparse to moderately dense (30-70%) subcanopy (5-20 m) are dominated by *Quercus alba* (white oak) and *Quercus falcata* (southern red oak); additional species may include *Acer saccharum* (sugar maple), *Carya texana* (black hickory), and *Quercus rubra* (northern red oak). The sparse to very dense (20-90%) tall-shrub layer (2-10 m) is made up of saplings of canopy species as well as *Cornus florida* (flowering dogwood), *Morus rubra* (red mulberry), *Viburnum rufidulum* (rusty blackhaw), and others. The sparse to moderate (10-50%) short-shrub layer (0.5-2 m) consistently includes *Cercis canadensis* (eastern redbud), *Frangula caroliniana* (Carolina buckthorn), *Fraxinus americana* (white ash), *Prunus serotina* (black cherry), and *Ulmus alata* (winged elm). The sparse to nearly continuous (20-90%) herbaceous layer is dominated by *Parthenocissus quinquefolia* (Virginia creeper) and *Toxicodendron radicans* (eastern poison-ivy); additional common species include *Amphicarpaea bracteata* (American hogpeanut), *Cynoglossum virginianum* (wild comfrey), *Desmodium* (ticktrefoil) spp., *Dichanthelium boscii* (Bosc's panicgrass), *Galium circaezans* (licorice bedstraw), *Smilax bona-nox* (saw greenbrier), and *Vitis aestivalis* (summer grape).
Global Vegetation: The canopy of stands of this association typically contains a mixture of *Quercus falcata* (southern red oak), *Carya alba* (mockernut hickory), and *Carya ovata* (shagbark hickory). Other characteristic species include *Quercus velutina* (black oak).

MOST ABUNDANT SPECIES

Buffalo National River

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Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Carya texana* (black hickory), *Quercus alba* (white oak)
Tree canopy	Broad-leaved deciduous tree	*Quercus falcata* (southern red oak)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Cornus florida* (flowering dogwood)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper)
Herb (field)	Forb	*Toxicodendron radicans* (eastern poison-ivy)

CHARACTERISTIC SPECIES

Buffalo National River: *Carya texana* (black hickory), *Cornus florida* (flowering dogwood), *Frangula caroliniana* (Carolina buckthorn), *Morus rubra* (red mulberry), *Parthenocissus quinquefolia* (Virginia creeper), *Quercus alba* (white oak), *Quercus falcata* (southern red oak), *Toxicodendron radicans* (eastern poison-ivy), *Viburnum rufidulum* (rusty blackhaw)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Carex mesochorea* (midland sedge, state-imperiled, G4G5); **Exotic/Invasive**: *Lonicera japonica* (Japanese honeysuckle, exotic, High/Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3Q (30-Jul-2002). The conservation rank of this community has not yet been completely assessed. Its rank (G3Q) is preliminary, based on its being apparently restricted to eastern Oklahoma and adjacent Arkansas. The Q on the rank means that it would be regarded as more common if it were to be merged with more widespread types.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: More work needs to be done to define this association and to determine its relationship to other deciduous forests defined for the Ouachitas and Ozarks. The concept of this association may be covered in associations of other alliances.

ELEMENT DISTRIBUTION

Buffalo National River Range: This dry-mesic oak - hickory forest was sampled along the Buffalo River Trail near Boxley Bridge, north of Ponca, along Rush Mountain Trail and Indian Rockhouse Trail, and near Tyler Bend.
Global Range: This association is currently defined from eastern Oklahoma (Adair, Cherokee, Choctaw, Haskell, Latimer, LeFlore, McCurtain, and Pushmataha counties), and stands have been identified in the Ozarks of Arkansas. It may be determined to be more wide-ranging once comparisons are made with other similar vegetation in the Ozarks and Ouachitas.
Nations: US
States/Provinces: AR, OK
TNC Ecoregions: 38:C, 39:C, 40:?
USFS Ecoregions (1994/95): 222Ag:CCC, 231:P, M222Aa:CCC, M231A:CC
Federal Lands: NPS (Buffalo River); USFS (Ouachita (Coastal Plain)?, Ouachita (Mountains)?, Ouachita?, Ozark?)

ELEMENT SOURCES

Buffalo National River Plots: (5 plots): BUFF.066, BUFF.089, BUFF.102, BUFF.132, BUFF.179.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: B. Hoagland
References: Hoagland 2000, Rice and Penfound 1959, Southeastern Ecology Working Group n.d.

Blackjack Oak Xeric Scrub

***Quercus marilandica / Vaccinium arboreum / Danthonia spicata* Scrub Woodland**
Blackjack Oak / Farkleberry / Poverty Oatgrass Scrub Woodland
Identifier: CEGL002425

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Southern Hardwood & Pine Forest (M016)
Group	South-Central Interior Oak Forest (G159)
Association (Common name)	Blackjack Oak Xeric Scrub

ELEMENT CONCEPT

Global Summary: This xeric blackjack oak type is found in the Interior Highlands region and western edge of the Interior Low Plateau of the United States. Stands occur on xeric bedrock outcrops on moderately steep to steep south- or southwest-facing slopes and ridgetops of hills and mountains. Soils are rapidly drained and very shallow (0-40 cm). Parent material may be igneous or sandstone. The bedrock is often exposed with fragments of rocks and boulders strewn over the surface. The canopy is stunted (3-8 m) and forms a scrub woodland dominated by *Quercus marilandica* (blackjack oak). Some *Quercus stellata* (post oak) is present. The shrub layer is typically sparse (<50% cover) and contains *Vaccinium arboreum* (farkleberry), or occasional *Vaccinium pallidum* (Blue Ridge blueberry). The herb layer is sparse (<50% cover). Typical species include *Danthonia spicata* (poverty oatgrass), along with

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Allium canadense var. mobilense (meadow garlic), *Cunila origanoides* (common dittany), *Dichanthelium acuminatum* (tapered rosette grass), *Diodia teres* (poorjoe). Mosses and lichens are often prevalent, including the mosses *Polytrichum* (polytrichum moss) spp. and the lichens *Cladina subtenuis* (reindeer lichen), *Flavoparmelia baltimorensis* (Baltimore flavoparmelia lichen), and *Myelochroa obsessa* (myelochroa lichen).

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This xeric oak forest was sampled once in the park near Tyler Bend. The site is a steep, south-facing scree slope bedrock outcrop with xeric, well-drained clay loam soil. The unvegetated surface is made up of leaf litter (54% cover), with some bedrock (3%), large rocks (15%), small rocks (25%), wood (2%), and bare soil (1%). Evidence of disturbance includes past fire (charred wood).

Global Environment: Stands occur on xeric bedrock outcrops on moderately steep to steep south- or southwest-facing slopes and ridgetops of hills and mountains. Soils are rapidly drained and very shallow (0-40 cm). Parent material may be igneous or sandstone. The bedrock is often exposed with fragments of rocks and boulders strewn over the surface (Nelson 1985).

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The very sparse (10% cover) tree canopy, 15-20 m tall, is dominated by *Quercus stellata* (post oak), as is the sparse (20%) tall-shrub layer (2-5 m) which also includes small amounts of *Carya texana* (black hickory) and *Quercus muehlenbergii* (chinkapin oak). The moderate (50%) short-shrub layer (0.5-1 m) is dominated by *Rhus aromatica* (fragrant sumac) and *Cercis canadensis* (eastern redbud) along with saplings of canopy species. The moderate (50%) herbaceous layer includes *Acacia angustissima* (prairie acacia), *Desmodium perplexum* (perplexed ticktrefoil), *Glandularia canadensis* (rose mock vervain), *Lespedeza procumbens* (trailing lespedeza), *Smilax bona-nox* (saw greenbrier), and *Vitis aestivalis* (summer grape), among others.

Global Vegetation: The canopy is stunted (3-8 m) and forms a scrub woodland dominated by *Quercus marilandica* (blackjack oak). Some *Quercus stellata* (post oak) is present. The shrub layer is typically sparse (<50% cover) and contains *Vaccinium arboreum* (farkleberry), or occasional *Vaccinium pallidum* (Blue Ridge blueberry). The herb layer is sparse (<50% cover). Typical species include *Danthonia spicata* (poverty oatgrass), along with *Allium canadense var. mobilense* (meadow garlic), *Cunila origanoides* (common dittany), *Dichanthelium acuminatum* (tapered rosette grass), *Diodia teres* (poorjoe). Mosses and lichens are often prevalent, including the mosses *Polytrichum* (polytrichum moss) spp. and the lichens *Cladina subtenuis* (reindeer lichen), *Flavoparmelia baltimorensis* (Baltimore flavoparmelia lichen), and *Myelochroa obsessa* (myelochroa lichen) (Nelson 1985).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus stellata* (post oak)
Short shrub/sapling	Broad-leaved deciduous shrub	*Rhus aromatica* (fragrant sumac)
Herb (field)	Vine/Liana	*Smilax bona-nox* (saw greenbrier)

Global

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus marilandica* (blackjack oak), *Quercus stellata* (post oak), *Quercus velutina* (black oak)
Short shrub/sapling	Broad-leaved evergreen tree	*Vaccinium arboreum* (farkleberry)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge), *Danthonia spicata* (poverty oatgrass), *Koeleria macrantha* (prairie Junegrass), *Schizachyrium scoparium* (little bluestem)

CHARACTERISTIC SPECIES

Buffalo National River: *Quercus stellata* (post oak), *Rhus aromatica* (fragrant sumac), *Smilax bona-nox* (saw greenbrier)

Global: *Clitoria mariana* (Atlantic pigeonwings), *Danthonia spicata* (poverty oatgrass), *Liatris squarrosa* (scaly blazing star), *Quercus marilandica* (blackjack oak), *Quercus stellata* (post oak), *Quercus velutina* (black oak), *Schizachyrium scoparium* (little bluestem), *Vaccinium arboreum* (farkleberry)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (24-Oct-2002). This type has been defined based primarily on the Missouri state classification. Although this type requires somewhat restricted environmental conditions, it likely occurs in other portions of the Interior Highland region and Interior Low Plateau where these conditions exist. It is primarily located on xeric bedrock outcrops with rapidly drained, shallow soils and igneous or sandstone parent material. This type may be associated with a glade/forest mosaic. More information on the status of this type is needed.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

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Buffalo National River Comments: The plot sampled at Buffalo National River seems to be in a variant of this type; *Quercus stellata* (post oak) is dominant, *Quercus marilandica* (blackjack oak) is minor, and there is no *Vaccinium arboreum* (farkleberry) (T. Foti).

Global Comments: The concept of the type is mainly taken from the Missouri state classification's Xeric Acid (Igneous, Sandstone) Forest (Nelson 1985). Chert substrates are unlikely to contain this type. This scrub woodland type may also be treated as a phase of either sandstone or igneous glades. *Quercus stellata* (post oak) can be present. Compare with *Quercus stellata - Quercus marilandica var. ashei* Interior Highlands Scrub Woodland (CEGL003884). Pure *Quercus marilandica* (blackjack oak) vegetation is uncommon in the Arkansas Ozarks (D. Zollner pers. comm. 2000).

Global Similar Associations:

Quercus alba / Carex pensylvanica - Carex ouachitana Dwarf Forest (CEGL002433) montane (high-elevation) type.
Quercus stellata - Quercus marilandica var. ashei Interior Highlands Scrub Woodland (CEGL003884) montane (high-elevation) type.
Schizachyrium scoparium - Sorghastrum nutans - Coreopsis lanceolata - Croton willdenowii Wooded Herbaceous Vegetation (CEGL002243)

Global Related Concepts:

Igneous Glade (Nelson 1985) ><
Xeric Chert Forest (Nelson 1985) <
Xeric Chert Forest, Xeric Igneous Forest, Xeric Sandstone Forest (Nelson 1985) **?**
Xeric Igneous Forest (Nelson 1985) <
Xeric Sandstone Forest (Nelson 1985) <

ELEMENT DISTRIBUTION

Buffalo National River Range: This xeric oak forest was sampled near Tyler Bend.

Global Range: This xeric blackjack oak type is found in the Interior Highlands of the central United States, including the Ozarks, Ouachitas, and Interior Low Plateau regions.

Nations: US

States/Provinces: AR, IL:S2, MO, OK?

TNC Ecoregions: 32:?, 38:C, 39:C, 43:P, 44:C

USFS Ecoregions (1994/95): 222Aa:CCC, 222Ac:CCC, 222Ae:CCC, 222Af:CCC, 222Aj:CCC, 222Ak:CCC, 222Am:CCC, 222An:CCC, 222Aq:CCP, 222Ca:CPP, 222Dh:CCC, 222Di:CCP, 231Gb:CCC, 231Gc:CCC, M231Aa:CCC

Federal Lands: NPS (Buffalo River, Ozark Riverways); USFS (Ouachita, Ouachita (Mountains), Ozark, Shawnee)

ELEMENT SOURCES

Buffalo National River Plots: (1 plot): BUFF.740.

Local Description Authors: M.J. Russo and T. Foti

Global Description Authors: D. Faber-Langendoen

References: Chastain et al. 2006, Madany 1981, Midwestern Ecology Working Group n.d., Nelson 1985, Nigh et al. 2000, White and Madany 1978, Zollner pers. comm.

Midwest Post Oak - Blackjack Oak Forest

***Quercus stellata - Quercus marilandica - Carya (glabra, texana) / Vaccinium arboreum* Forest**
Post Oak - Blackjack Oak - (Pignut Hickory, Black Hickory) / Farkleberry Forest
Identifier: CEGL002075

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Southern Hardwood & Pine Forest (M016)
Group	South-Central Interior Oak Forest (G159)
Association (Common name)	Midwest Post Oak - Blackjack Oak Forest

ELEMENT CONCEPT

Global Summary: This post oak - blackjack oak forest is found most commonly in the Interior Highlands and Interior Low Plateau regions. Stands occurs in isolated patches on dry, rapidly drained, shallow soils. Bedrock can be sandstone, chert, or igneous material, and rock fragments, cobbles, or boulders are commonly strewn over the surface. This forest is best developed on south- and west-facing slopes and ridgetops of steep-walled valleys and canyons. Typical tree species dominants include *Quercus stellata* (post oak), mixed with a variety of other oaks, including *Quercus marilandica* (blackjack oak), *Quercus alba* (white oak), *Quercus falcata* (southern red oak), and *Quercus velutina* (black oak). The tree canopy is short (20-50 feet), slow-growing, and open. Tree crowns are spreading, open, and limby. The understory is poorly developed and consists of widely scattered shrubs. Typical species include *Vaccinium arboreum* (farkleberry), *Amelanchier arborea* (common serviceberry), and *Ostrya virginiana* (hophornbeam). Herbaceous cover is sparse, and mosses and lichens are abundant. In Kentucky, common herbaceous species include *Tephrosia virginiana* (Virginia tephrosia), *Euphorbia corollata* (flowering spurge), and *Danthonia spicata* (poverty oatgrass). In Arkansas, herbaceous species include *Carex umbellata* (parasol sedge) and *Carex hirsutella* (fuzzy wuzzy sedge).

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ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This post oak forest was sampled on two rocky slope locations in the park. One site is a moderately sloped, east-facing interfluve with well-drained loam soil. The other is a steep southwest-facing midslope with rapidly drained sandy loam soil. The unvegetated surface is dominated by leaf litter (90-96% cover), with some exposed bedrock (1-3%), large rocks (2%), small rocks (0-2%), and wood (1-2%). Evidence of disturbance includes nearby trails.
Global Environment: This community is found on dry, upper slopes and ridgetops. Bedrock is most often igneous materials or chert which suggests neutral to slightly acidic pH. Soils are typically shallow, droughty, and infertile. Bedrock pavement, boulders, cobble, gravel, and sand are strewn over the surface, contributing significantly to soil droughtiness and increased soil temperatures (Nelson 1985, TNC 1995a). The key environmental variables affecting species composition in this community are elevated temperatures and limited moisture availability. Bedrock and associated soil chemistry also determine floristic composition (TNC 1995a).

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The sparse to moderate (10-40% cover) tree canopy (15-20 m tall) and moderate (40-50%) subcanopy (10-15 m) are dominated by *Quercus stellata* (post oak); additional tree species may include *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Quercus muehlenbergii* (chinkapin oak), *Quercus rubra* (northern red oak), and *Quercus velutina* (black oak). The moderately dense (60-70%) tall-shrub (2-5 m) and short-shrub (0.5-1 m) layers are comprised of canopy species as well as *Celtis occidentalis* (common hackberry), *Fraxinus americana* (white ash), *Juniperus virginiana* (eastern red-cedar), *Prunus mexicana* (Mexican plum), *Rhus aromatica* (fragrant sumac), *Sideroxylon lanuginosum* (gum bully), and *Ulmus alata* (winged elm), among others. The sparse (20-30%) herbaceous layer is dominated by *Desmodium* (ticktrefoil) spp. and *Lespedeza* (lespedeza) spp.
Global Vegetation: This community is a broad-leaved deciduous forest type. Canopy closure is often incomplete but may be more than 60%. Typical tree species dominants include *Quercus stellata* (post oak), mixed with a variety of other oaks, including *Quercus marilandica* (blackjack oak), *Quercus alba* (white oak), *Quercus falcata* (southern red oak), and *Quercus velutina* (black oak). The tree canopy is short (8-20 m), slow-growing, and open. The understory is poorly developed and consists of widely scattered shrubs. Typical species include *Amelanchier arborea* (common serviceberry), *Ostrya virginiana* (hophornbeam), and *Vaccinium arboreum* (farkleberry). Dwarf-shrubs include *Hypericum punctatum* (spotted St. Johnswort), *Hypericum hypericoides ssp. multicaule* (St. Andrew's cross), *Rosa carolina* (Carolina rose), and *Toxicodendron radicans* (eastern poison-ivy). Herbaceous cover is sparse. Species include *Antennaria plantaginifolia* (woman's tobacco), *Symphyotrichum patens* (late purple aster), *Danthonia spicata* (poverty oatgrass), *Dichanthelium commutatum* (variable panicgrass), *Dichanthelium laxiflorum* (openflower rosette grass), *Helianthus divaricatus* (woodland sunflower), *Hieracium gronovii* (queendevil), *Lespedeza hirta* (hairy lespedeza), and *Schizachyrium scoparium* (little bluestem). Mosses and lichens are abundant and important contributors to species diversity where bedrock is prevalent (Nelson 1985, TNC 1995a). The presence of *Vaccinium arboreum* (farkleberry) is part of what distinguishes this type from the related CEGL002074 of the Crosstimbers to the west (B. Hoagland pers. comm.).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus stellata* (post oak)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Fraxinus americana* (white ash), *Rhus aromatica* (fragrant sumac)

Global

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus alba* (white oak), *Quercus falcata* (southern red oak), *Quercus marilandica* (blackjack oak), *Quercus stellata* (post oak), *Quercus velutina* (black oak)
Tall shrub/sapling	Needle-leaved tree	*Juniperus virginiana* (eastern red-cedar)
Tall shrub/sapling	Broad-leaved deciduous tree	*Amelanchier arborea* (common serviceberry), *Crataegus phaenopyrum* (Washington hawthorn)
Tall shrub/sapling	Broad-leaved evergreen tree	*Vaccinium arboreum* (farkleberry)
Herb (field)	Forb	*Cunila origanoides* (common dittany), *Helianthus divaricatus* (woodland sunflower)
Herb (field)	Graminoid	*Danthonia spicata* (poverty oatgrass)

CHARACTERISTIC SPECIES

Buffalo National River: *Carya glabra* (pignut hickory), *Celtis occidentalis* (common hackberry), *Fraxinus americana* (white ash), *Quercus stellata* (post oak), *Quercus velutina* (black oak), *Rhus aromatica* (fragrant sumac)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Exotic/Invasive: *Ailanthus altissima* (tree of heaven, exotic, Medium)
Global: Other: *Accipiter cooperii* (cooper's hawk, G5), *Caprimulgus carolinensis* (chuck-will's-widow, G5), *Caprimulgus vociferus* (whip-poor-will, G5), *Coragyps atratus* (black vulture, G5), *Glaucomys volans* (southern flying squirrel, G5), *Helmitheros*

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vermivorum (worm-eating warbler, G5), *Lynx rufus* (bobcat, G5), *Meleagris gallopavo* (wild turkey, G5), *Odocoileus virginianus* (white-tailed deer, G5), *Piranga rubra* (summer tanager, G5), *Sciurus carolinensis* (eastern gray squirrel, G5), *Tamias striatus* (eastern chipmunk, G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (3-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Buffalo National River Comments: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.
Global Comments: The presence of *Vaccinium arboreum* (farkleberry) is part of what distinguishes this type from the related CEGL002074 of the Crosstimbers to the west (B. Hoagland pers. comm.). In Kentucky this is a common forest on sandstone ridges in the Shawnee Hills (222Da, 222De, 222Dg, 222Dj). Kentucky occurrences are often old-growth, gnarly woodlands. Concept and distribution of this association in the Southeast needs assessment. Distinguishing this community from *Quercus stellata - Quercus marilandica - Quercus velutina - Carya texana / Schizachyrium scoparium* Woodland (CEGL002149) can be difficult when canopy cover is at or near 60%. Black hickory is diagnostic for this community, which is most common west of the Mississippi Alluvial Basin. Where *Quercus alba* (white oak) is codominant with either post oak or blackjack oak, suggesting types are less xeric, stands belong in the *Quercus alba - (Quercus rubra*, *Carya* (hickory) spp.) Forest Alliance (A.239) or the *Quercus velutina - Quercus alba - (Quercus coccinea)* Forest Alliance (A.1911). Braun (1950) summarizes information on this type in the Ozarks of Missouri and Arkansas. Anderson (1996) notes that this type may be found in southwestern Ohio, but further review is needed.
Global Similar Associations:
Quercus falcata - Quercus alba - Carya alba / Oxydendrum arboreum / Vaccinium stamineum Forest (CEGL007244)
Quercus muehlenbergii - Quercus (falcata, shumardii, stellata) / Cercis canadensis / Viburnum rufidulum Forest (CEGL007699)
Quercus stellata - Quercus marilandica - (Carya texana) Forest (CEGL002074) this type is more westerly in distribution (ECO32 and ECO37).
Quercus stellata - Quercus marilandica - Quercus velutina - Carya texana / Schizachyrium scoparium Woodland (CEGL002149)
Global Related Concepts:
Quercus stellata - Quercus marilandica / Danthonia community (Voigt and Mohlenbrock 1964) >
Dry Chert Forest (Nelson 1985) ><
Dry Igneous Forest (Nelson 1985) ><
Dry Sandstone Forest (Nelson 1985) ><
Eastern Broadleaf Forests: 100: Oak-Hickory Forest (*Quercus-Carya*) (Kuchler 1964) >
Post Oak - Blackjack Oak: 40 (Eyre 1980) >
Terrestrial: Forest: Hardwood (TNC 1985) >
UNESCO FORMATION CODE: I.B.3a (UNESCO 1973) >

ELEMENT DISTRIBUTION

Buffalo National River Range: This association was sampled along Rush Trail.
Global Range: This community is found in Arkansas, Illinois, Indiana, Kentucky, Missouri, and Oklahoma. Reports from southwest Ohio need verification.
Nations: US
States/Provinces: AR, IL, IN, KY, MO, OK
TNC Ecoregions: 38:C, 39:C, 44:C
USFS Ecoregions (1994/95): 222Aa:CCC, 222Ab:CCC, 222Ac:CCC, 222Ad:CCC, 222Af:CCC, 222Ag:CCC, 222Ak:CCC, 222Aq:CCC, 222Dc:CCC, 222De:CCC, 222Df:CCP, 222Dh:CCC, 222Di:CCC, 222El:CCC, 222Ga:CCC, 255A:PP, 255C:PP, M222A:PP, M231A:PP
Federal Lands: NPS (Buffalo River, Ozark Riverways); USFS (Ouachita (Mountains)?, Ouachita?, Ozark, Shawnee)

ELEMENT SOURCES

Buffalo National River Plots: (2 plots): BUFF.181, BUFF.184.
Local Description Authors: M.J. Russo
Global Description Authors: M. Guetersloh
References: Anderson 1996, Braun 1950, Buck 1964, Chastain et al. 2006, Evans 1991, Eyre 1980, Fralish 1987, Fralish 1988b, Fralish et al. 1991, Hoagland 1997, Hoagland 2000, Hoagland pers. comm., Kennedy 1973, Kuchler 1964, McCoy 1958, Midwestern Ecology Working Group n.d., Nelson 1985, Nigh et al. 2000, Rice and Penfound 1959, Roe 1998, TNC 1985, TNC 1995a, Taylor 1967, UNESCO 1973, Voigt and Mohlenbrock 1964, White and Madany 1978

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Ozark/Ouachita Post Oak - Blackjack Oak / Little Bluestem Woodland

***Quercus stellata - Quercus marilandica - Quercus velutina - Carya texana / Schizachyrium scoparium* Woodland**

Post Oak - Blackjack Oak - Black Oak - Black Hickory / Little Bluestem Woodland

Identifier: CEGL002149

NVC CLASSIFICATION

Division	Eastern North American Cool Temperate Forest (1.B.2.Na)
Macrogroup	Southern Hardwood & Pine Forest (M016)
Group	South-Central Interior Oak Forest (G159)
Association (Common name)	Ozark/Ouachita Post Oak - Blackjack Oak / Little Bluestem Woodland

ELEMENT CONCEPT

Global Summary: This post oak - blackjack oak woodland type occurs in the central United States, particularly in the Interior Low Plateau and Interior Highlands region. Stands occur on gentle to steep hills and plains, bluff escarpments, and broad ridges and flats with any aspect, but primarily south- and west-facing slopes. Soils are rapidly to very rapidly drained, shallow, and strewn with boulders, cobbles, gravel, and sand. Soil pH is neutral to slightly acidic. Bedrock can be sandstone, chert, or igneous rock and is often exposed. The tree canopy is short to medium (7-20 m), spreading, open, and limby. Dominant species include *Quercus stellata* (post oak) and/or *Quercus marilandica* (blackjack oak). Other species may form a minor canopy component, scattered in the canopy, and include (e.g., *Quercus velutina* (black oak), *Quercus rubra* (northern red oak), *Quercus alba* (white oak), and *Carya alba* (mockernut hickory)). The understory is very poorly developed, consisting of a few widely scattered shrubs and small trees, including, in addition to the dominant trees, *Ulmus alata* (winged elm) and *Vaccinium* (blueberry) spp. (*Vaccinium arboreum* (farkleberry), *Vaccinium stamineum* (deerberry), or *Vaccinium pallidum* (Blue Ridge blueberry)). Coverage of the herbaceous stratum can vary from quite sparse to moderately dense, consisting of mixed grasses and forbs. Typical species include *Helianthus divaricatus* (woodland sunflower), *Porteranthus stipulatus* (Indian physic), *Danthonia spicata* (poverty oatgrass), *Schizachyrium scoparium* (little bluestem), *Cunila origanoides* (common dittany), *Andropogon gerardii* (big bluestem), and *Liatris aspera* (tall blazing star), but others may occur. Lichens and mosses can be abundant.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This post oak / little bluestem woodland was sampled at five locations in the park. Sites are moderate to somewhat steep mid and upper slopes of mostly western aspects. Soils range from xeric, rocky, rapidly drained silt, clay and clay loam to dry-mesic moderately well- to well-drained sandy loam and loam. The unvegetated surface is made up of leaf litter (25-97% cover), bedrock (0-20%), large rocks (0-30%), small rocks (1-20%), wood (0-1%), and bare soil (0-48%). Evidence of disturbance includes trails, impacts from human activities, and nearby fire.

Global Environment: Stands occur on gentle to steep hills and plains, bluff escarpments, and broad ridges and flats with any aspect, but primarily south- and west-facing slopes. Soils are rapidly to very rapidly drained, shallow, and strewn with boulders, cobbles, gravel, and sand. Soil pH is neutral to slightly acidic. Bedrock can be sandstone, chert, or igneous rock and is often exposed (Nelson 1985, TNC 1995a). Drought and heat stress limit vegetative densities and woody recruitment, and high light levels are important for understory species (Fralish 1988b). Periodic naturally occurring fire is important for maintenance of this natural community.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The sparse to moderate (20-70% cover) tree canopy, 10-20 m tall, is dominated by *Quercus stellata* (post oak) and may include *Carya glabra* (pignut hickory), *Carya texana* (black hickory), *Quercus alba* (white oak), and/or *Quercus marilandica* (blackjack oak). The sparse to moderately dense (20-70%) tall-shrub layer (2-5 m) may include canopy tree saplings as well as *Amelanchier arborea* (common serviceberry), *Celtis tenuifolia* (dwarf hackberry), *Cercis canadensis* (eastern redbud), *Diospyros virginiana* (common persimmon), *Juniperus virginiana* (eastern red-cedar), *Rhus copallinum* (winged sumac), *Sideroxylon lanuginosum* (gum bully), and *Ulmus alata* (winged elm). The very sparse to moderate (5-60%) short-shrub layer (0.5-1 m) is generally made up of species from the upper layers. The very sparse to moderate (10-60%) herbaceous layer includes *Acacia angustissima* (prairie acacia), *Danthonia spicata* (poverty oatgrass), *Lespedeza violacea* (violet lespedeza), *Schizachyrium scoparium* (little bluestem), *Scleria oligantha* (littlehead nutrush), and *Tephrosia virginiana* (Virginia tephrosia). Vines include *Smilax bona-nox* (saw greenbrier) and *Smilax rotundifolia* (roundleaf greenbrier).

Global Vegetation: The tree canopy is short to medium (7-20 m), spreading, open, and limby. Dominant species include *Quercus stellata* (post oak) and/or *Quercus marilandica* (blackjack oak). Other species may form a minor canopy component, scattered in the canopy, and include *Quercus velutina* (black oak), *Quercus rubra* (northern red oak), *Quercus alba* (white oak), and *Carya alba* (mockernut hickory). The understory is very poorly developed, consisting of a few widely scattered shrubs and small trees, including, in addition to the dominant trees, *Ulmus alata* (winged elm) and *Vaccinium* (blueberry) spp. (*Vaccinium arboreum* (farkleberry), *Vaccinium stamineum* (deerberry), or *Vaccinium pallidum* (Blue Ridge blueberry)). Coverage of the herbaceous stratum can vary from quite sparse to moderately dense, consisting of mixed grasses and forbs. Typical species include *Helianthus divaricatus* (woodland sunflower), *Porteranthus stipulatus* (Indian physic), *Danthonia spicata* (poverty oatgrass), *Schizachyrium scoparium* (little bluestem), *Cunila origanoides* (common dittany), *Andropogon gerardii* (big bluestem), and *Liatris aspera* (tall blazing star), but others may occur. Lichens and mosses can be abundant (Nelson 1985, TNC 1995a).

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MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Carya texana* (black hickory), *Quercus stellata* (post oak)
Shrub/sapling (tall & short)	Needle-leaved shrub	*Juniperus virginiana* (eastern red-cedar)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Carya texana* (black hickory), *Quercus stellata* (post oak)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Diospyros virginiana* (common persimmon), *Quercus marilandica* (blackjack oak), *Rhus copallinum* (winged sumac), *Ulmus alata* (winged elm)
Herb (field)	Forb	*Acacia angustissima* (prairie acacia)

CHARACTERISTIC SPECIES

Buffalo National River: *Acacia angustissima* (prairie acacia), *Amelanchier arborea* (common serviceberry), *Carya texana* (black hickory), *Diospyros virginiana* (common persimmon), *Juniperus virginiana* (eastern red-cedar), *Lespedeza violacea* (violet lespedeza), *Quercus marilandica* (blackjack oak), *Quercus stellata* (post oak), *Rhus copallinum* (winged sumac), *Scleria oligantha* (littlehead nutrush), *Smilax bona-nox* (saw greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Tephrosia virginiana* (Virginia tephrosia), *Ulmus alata* (winged elm)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (22-Jun-1998). There are probably fewer than 100 occurrences rangewide. Currently 29 occurrences have been documented in Missouri where it is ranked S2; the community is also reported from Arkansas, Oklahoma, and Indiana where it is ranked S?, S?, and S1, respectively. This community may also occur in Illinois. There are probably less than 15,000 acres rangewide. Currently there are about 4700 acres documented from Missouri, and most occurrences are less than 1500 acres. This community was once widespread throughout its range. It has been significantly impacted and continues to be threatened by grazing, overseeding with non-native grasses, and conversion to forest due to fire suppression. Some expansion of individual occurrences may have occurred due to extensive logging of pines. About half the currently documented occurrences are ranked A or B, with sizes ranging from 30 to 1200 acres.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Buffalo National River Comments: One of the plots classified to this association is heavily dominated by *Juniperus virginiana* (eastern red-cedar) (T. Foti).
Global Comments: The concept of this type is somewhat related to the Missouri state type Acid (Chert, Igneous, Sandstone) Savanna (Nelson 1985), and also includes woodland phases of Illinois' dry barrens, including those in the Cretaceous Hills (White and Madany 1978). Illinois prefers *Danthonia spicata* (poverty oatgrass) as an herb layer nominal species (they have no *Schizachyrium scoparium* (little bluestem) in this community). This type has been managed with fire in the Shawnee National Forest, forming a "woodland barrens" type [see *Quercus stellata - Quercus marilandica / Schizachyrium scoparium* Wooded Herbaceous Vegetation (CEGL002391) for the " open barrens" type]. This association should be compared with and distinguished from *Quercus stellata - Quercus marilandica - Carya (glabra, texana) / Vaccinium arboreum* Forest (CEGL002075). *Quercus alba - Quercus stellata - Quercus velutina / Schizachyrium scoparium* Woodland (CEGL002150) is a similar, moister type. Several related types are documented in the West Gulf Coastal Plain.
Global Similar Associations:
Quercus alba - Quercus stellata - Quercus velutina / Schizachyrium scoparium Woodland (CEGL002150)
Quercus marilandica - (Juniperus virginiana) / Schizachyrium scoparium - Danthonia spicata Wooded Herbaceous Vegetation (CEGL002428)
Quercus marilandica - Juniperus virginiana var. virginiana / Schizachyrium scoparium - Hypericum gentianoides Wooded Herbaceous Vegetation (CEGL004062)
Quercus muehlenbergii - Juniperus virginiana / Schizachyrium scoparium - Manfreda virginica Wooded Herbaceous Vegetation (CEGL005131)
Quercus stellata - Quercus alba - (Quercus falcata) / Schizachyrium scoparium Woodland (CEGL004217)
Quercus stellata - Quercus marilandica - Carya (glabra, texana) / Vaccinium arboreum Forest (CEGL002075)
Quercus stellata - Quercus marilandica / Schizachyrium scoparium Wooded Herbaceous Vegetation (CEGL002391)
Quercus stellata - Quercus marilandica / Schizachyrium scoparium Woodland (CEGL002147)
Schizachyrium scoparium - Sorghastrum nutans - Coreopsis lanceolata - Croton willdenowii Wooded Herbaceous Vegetation (CEGL002243)
Global Related Concepts:
Chert Savanna (Nelson 1985) ><
Eastern Broadleaf Forests: 100: Oak-Hickory Forest (*Quercus-Carya*) (Kuchler 1964) **?**
Igneous Savanna (Nelson 1985) ><
Post Oak - Blackjack Oak: 40 (Eyre 1980) >

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Sandstone Savanna (Nelson 1985) ><
Terrestrial: Woodland: Hardwood (TNC 1985) >
UNESCO FORMATION CODE: II.B.3a (UNESCO 1973) >

ELEMENT DISTRIBUTION

Buffalo National River Range: This post oak / little bluestem woodland was sampled along Rush Mountain Road, and near Tyler Bend, Erbie Campground, Buffalo Point, and Slatey Place on Kilgore Mountain.
Global Range: This post oak - blackjack oak woodland type occurs in the central United States, particularly in the Interior Low Plateau and Interior Highlands region, ranging from southern parts of both Indiana and Illinois south and west to Missouri, Arkansas, and Oklahoma.
Nations: US
States/Provinces: AR, IL, IN, MO, OK
TNC Ecoregions: 38:C, 39:C, 43:P, 44:C
USFS Ecoregions (1994/95): 222Ab:CCC, 222Ac:CCC, 222Ag:CCC, 222Ak:CCC, 222Am:CCC, 222An:CCC, 222Aq:CCP, 222Ca:CPP, 222Ch:CPP, 222De:CCC, 222Dh:CCP, 222Di:CCP, 222E:CP, 222Gc:CPP, 222Gd:CPP, 231E:CP, 231G:CC, M222Aa:CCC, M231A:CC
Federal Lands: DOD (Fort Chaffee); NPS (Buffalo River, Ozark Riverways); USFS (Ouachita, Ouachita (Mountains), Ozark, Shawnee)

ELEMENT SOURCES

Buffalo National River Plots: (5 plots): BUFF.139, BUFF.182, BUFF.183, BUFF.214, BUFF.762.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: M. Guetersloh, mod. M. Pyne and D. Faber-Langendoen
References: Allred and Mitchell 1955, Bruner 1931, Chastain et al. 2006, Collins and Klahr 1991, Diamond 1993, Ewing et al. 1984, Eyre 1980, Fralish 1987, Fralish 1988b, Fralish et al. 1991, Heikens and Robertson 1994, Hoagland 2000, Hutchison 1994, Johnson and Risser 1975a, Kennedy 1973, Klahr 1989, Kuchler 1964, Luckhardt and Barclay 1937, Midwestern Ecology Working Group n.d., Nelson 1985, Nigh et al. 2000, Penfound 1962, Rice and Penfound 1959, Robertson and Heikens 1994, Smith pers. comm., TNC 1985, TNC 1995a, Turner pers. comm., UNESCO 1973, Voigt and Mohlenbrock 1964, White and Madany 1978

1.B.3. Temperate Flooded & Swamp Forest

1.B.3.Na. Eastern North American Flooded & Swamp Forest

M029. Northern & Central Floodplain Forest & Scrub

G040. Silver Maple - Green Ash - Sycamore Floodplain

Southern Interior Box-elder Riparian Forest

***Acer negundo - (Platanus occidentalis, Populus deltoides)* Forest**
Box-elder - (American Sycamore, Eastern Cottonwood) Forest
Identifier: CEGL004690

NVC CLASSIFICATION

Division	Eastern North American Flooded & Swamp Forest (1.B.3.Na)
Macrogroup	Northern & Central Floodplain Forest & Scrub (M029)
Group	Silver Maple - Green Ash - Sycamore Floodplain (G040)
Association (Common name)	Southern Interior Box-elder Riparian Forest

ELEMENT CONCEPT

Global Summary: This association represents forests on narrow floodplains, along streams and medium-sized rivers and Tennessee Valley Authority impoundments in Kentucky, Tennessee, Alabama, and Arkansas, where *Acer negundo* (box-elder) dominates, possibly with emergent *Platanus occidentalis* (American sycamore) and/or *Populus deltoides* (eastern cottonwood). It explicitly covers *Acer negundo* (box-elder)-dominated vegetation of streams, as opposed to *Acer negundo* Forest (CEGL005033), a type of larger rivers which has a greater documented distribution. This association (CEGL004690) covers smaller areas and may have a greater transition zone to other communities and consequently higher diversity. More information is needed on species composition and dynamics of this association in order to better distinguish it from CEGL005033. Composition is variable. In central Kentucky, a simple strip of *Acer negundo* (box-elder) and *Platanus occidentalis* (American sycamore), plus *Ulmus americana* (American elm), etc., is common along all medium-sized streams, with almost no *Acer saccharinum* (silver maple) or *Populus deltoides* (eastern cottonwood).

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ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This box-elder riparian forest was sampled at six locations in the park. Sites are flat to gently sloping, temporarily flooded stream terraces. Soils range from well-drained to poorly drained clay loam, silt loam and sandy loam. The unvegetated surface is dominated by leaf litter (45-99% cover), with some large rocks (0-2%), small rocks (0-50%), wood (0-5%), and bare soil (0-5%). Evidence of disturbance includes roads and trails, hydrologic alterations, fire, recent beaver activity, and the presence of exotic plants.
Global Environment: Stands occur on floodplains of streams and medium-sized rivers. They are typically temporarily flooded in the spring.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The very sparse to very dense (10-90% cover) tree canopy, 15-35 m tall, is dominated by *Acer negundo* (box-elder) and *Platanus occidentalis* (American sycamore) and may include *Carya cordiformis* (bitternut hickory), *Catalpa speciosa* (northern catalpa), *Celtis occidentalis* (common hackberry), *Gleditsia triacanthos* (honeylocust), *Juglans nigra* (black walnut), *Liquidambar styraciflua* (sweetgum), and *Ulmus americana* (American elm). The subcanopy (10-20 m) may be sparse to completely closed (30-100%) and includes canopy species as well as *Maclura pomifera* (osage orange) and *Morus rubra* (red mulberry). The sparse to closed (40-100%) tall-shrub layer (2-5 m) may be dominated by *Acer negundo* (box-elder), *Arundinaria gigantea* (giant cane) (one site), *Asimina triloba* (pawpaw), *Celtis occidentalis* (common hackberry), *Lindera benzoin* (northern spicebush), and/or *Ostrya virginiana* (hophornbeam). The very sparse to very dense (20-90%) short-shrub layer (0.5-1 m) includes tall-shrub species as well as *Asimina triloba* (pawpaw) and *Symphoricarpos orbiculatus* (coralberry). Common species in the herbaceous layer (0-70%) include *Amphicarpaea bracteata* (American hogpeanut), *Asarum canadense* (Canadian wildginger), *Elephantopus carolinianus* (Carolina elephantsfoot), *Geum canadense* (white avens), *Polygonum virginianum* (jumpseed), *Polymnia canadensis* (whiteflower leafcup), and *Viola sororia* (common blue violet). Vines include *Parthenocissus quinquefolia* (Virginia creeper), *Smilax bona-nox* (saw greenbrier), *Smilax tamnoides* (bristly greenbrier), and *Vitis vulpina* (frost grape). This community has been heavily infested by exotic species; 11 species were recorded from sampled plots. However, this community also supports globally and state-vulnerable *Delphinium newtonianum* (Newton's larkspur).
Global Vegetation: Stands are dominated by *Acer negundo* (box-elder), possibly with emergent *Platanus occidentalis* (American sycamore) and/or *Populus deltoides* (eastern cottonwood). In addition, *Ulmus americana* (American elm) may also be a canopy component in Kentucky, and *Acer saccharinum* (silver maple) and *Populus deltoides* (eastern cottonwood) will typically be lacking (J. Campbell pers. comm.). More information is needed on species composition, variation, and dynamics of this association in order to better distinguish it from *Acer negundo* (box-elder) Forest (CEGL005033), a type of larger rivers which has a greater documented distribution.

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer negundo* (box-elder), *Platanus occidentalis* (American sycamore)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Asimina triloba* (pawpaw)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer negundo* (box-elder), *Celtis occidentalis* (common hackberry)
Short shrub/sapling	Broad-leaved deciduous shrub	*Symphoricarpos orbiculatus* (coralberry)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper)
Herb (field)	Forb	*Asarum canadense* (Canadian wildginger), *Polymnia canadensis* (whiteflower leafcup)

CHARACTERISTIC SPECIES

Buffalo National River: *Acer negundo* (box-elder), *Asarum canadense* (Canadian wildginger), *Asimina triloba* (pawpaw), *Celtis occidentalis* (common hackberry), *Parthenocissus quinquefolia* (Virginia creeper), *Platanus occidentalis* (American sycamore), *Polymnia canadensis* (whiteflower leafcup), *Symphoricarpos orbiculatus* (coralberry)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Delphinium newtonianum* (Newton's larkspur, globally and state-vulnerable, G3);
Exotic/Invasive: *Albizia julibrissin* (silktree, exotic, High/Low), *Allium vineale* (wild garlic, exotic, Medium/Insignificant), *Cirsium vulgare* (bull thistle, exotic, Medium/Low), *Glechoma hederacea* (ground ivy, exotic, Low), *Lonicera japonica* (Japanese honeysuckle, exotic, High/Medium), *Microstegium vimineum* (Nepalese browntop, exotic, High/Medium), *Poa pratensis* (Kentucky bluegrass, exotic, Medium), *Rosa multiflora* (multiflora rose, exotic, Medium/Low), *Saponaria officinalis* (bouncingbet, exotic, Low/Insignificant), *Stellaria media* (common chickweed, exotic, Low)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (17-Dec-1999). This is an early-successional type, which has numerous but poorly documented occurrences. The rangewide occurrence of this type is complicated by the "weedy" nature of *Acer negundo* (box-elder). Decline has been moderate, primarily caused by disruption of the flooding regime by impoundments or by water withdrawals and interbasin transfers. The actual range of the type is probably greater than the data indicate. Many states do not track this vegetation as it is

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early-successional. It may not be adequately distinguished in the data or the literature from the related *Acer negundo* (box-elder) Forest (CEGL005033), a type of larger rivers. Admittedly, it is unclear what the EOrank criteria are for an early-successional type. The Grank was changed from the ambiguous G3G5 to G4 based on information from state ecologists which clarified the concept and allowed it to be conceptually differentiated from CEGL005033.

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Global Comments: More information is needed on species composition and environmental variables to better distinguish this type (CEGL004690) and *Acer negundo* (box-elder) Forest (CEGL005033). Tom Foti (pers. comm.) states that the small stream *Acer negundo* (box-elder) type (CEGL004690) covers small areas and may have a greater transition zone to other communities and consequently higher diversity. In contrast, the big river *Acer negundo* (box-elder) type (CEGL005033) can cover hundreds of acres with relatively little ecotone and may consist of pure *Acer negundo* (box-elder). In central Kentucky, a simple strip of *Acer negundo* (box-elder) and *Platanus occidentalis* (American sycamore), plus *Ulmus americana* (American elm), etc., is common along all medium-sized streams, with almost no *Acer saccharinum* (silver maple) or *Populus deltoides* (eastern cottonwood) (J. Campbell pers. comm.). Most Natural Heritage programs do not track this successional type, and relatively little information is available on its detailed composition and dynamics. Its apparently limited range may simply be due to its failure to be distinguished from the big river type or from other small stream floodplain associations.
Global Similar Associations:
Acer negundo Forest (CEGL005033)
Platanus occidentalis - (Populus deltoides) - Acer negundo Forest (CEGL002092)

ELEMENT DISTRIBUTION

Buffalo National River Range: This box-elder forest was sampled near Tyler Bend (Spring Hollow Trail), Rush Creek, Rush Landing, and Pruitt Bridge.
Global Range: This *Acer negundo* (box-elder) small stream floodplain forest is best documented in central Kentucky; its full distribution is not known. It presumably occurs in Tennessee and is reported from Alabama and Arkansas. It could be found sporadically on small stream floodplains in the southern, eastern, and midwestern United States throughout the range of *Acer negundo* (box-elder). The actual range of the type is probably greater than the data indicate. Many states do not track this vegetation as it is early-successional. It may not be adequately distinguished in the data or the literature from the related CEGL005033, a type of larger rivers.
Nations: US
States/Provinces: AL, AR, KY, MS, TN, VA?
TNC Ecoregions: 38:C, 40:?, 43:C, 44:C, 50:C
USFS Ecoregions (1994/95): 221Ha:CCC, 221Hc:CCC, 221Hd:CC?, 221He:CCC, 221Ja:CP?, 221Jb:CP?, 221Jc:CP?, 222Ag:CCC, 222An:CCC, 222Ca:CC?, 222Cb:CC?, 222Cc:CC?, 222Cd:CC?, 222Ce:CC?, 222Cf:CC?, 222Cg:CCC, 222Ch:CC?, 222Ea:CC?, 222Eb:CCC, 222Ec:CC?, 222Ed:CCC, 222Ee:CC?, 222Ef:CC?, 222Eg:CCC, 222Eh:CC?, 222Ei:CC?, 222Ej:CCC, 222Ek:CC?, 222En:CCC, 222Eo:CCC, 222Fa:CP?, 222Fb:CP?, 222Fc:CP?, 222Fd:CP?, 222Ff:CP?, 231Ba:CCC, 231Bd:CCC, 232Bb:CCC, M221Cd:CCC
Federal Lands: NPS (Buffalo River, Natchez Trace, Stones River); USFS (Daniel Boone, Tuskegee)

ELEMENT SOURCES

Buffalo National River Plots: (6 plots): BUFF.146, BUFF.149, BUFF.169, BUFF.173, BUFF.205, BUFF.745.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: Southeast Ecology Group
References: Campbell pers. comm., Evans 1991, Foti pers. comm., Nordman 2004, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data

Box-elder Floodplain Forest

***Acer negundo* Forest**
Box-elder Forest
Identifier: CEGL005033

NVC CLASSIFICATION

Division	Eastern North American Flooded & Swamp Forest (1.B.3.Na)
Macrogroup	Northern & Central Floodplain Forest & Scrub (M029)
Group	Silver Maple - Green Ash - Sycamore Floodplain (G040)
Association (Common name)	Box-elder Floodplain Forest

ELEMENT CONCEPT

Global Summary: This semi-open to closed-canopy forest is found on floodplains in the southern, eastern, and midwestern United States. Stands occur on large rivers in the active floodplain and on sandbars, and may form farther from the riverfront following

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disturbance. Occurrences are mostly on higher floodplain terraces with less rocky soils which were used for agriculture or habitation. They are typically temporarily flooded in the spring. These early-successional forests are dominated by *Acer negundo* (box-elder). Other characteristic species include *Platanus occidentalis* (American sycamore), *Celtis laevigata* (sugarberry), *Acer rubrum* (red maple), *Liriodendron tulipifera* (tuliptree), *Robinia pseudoacacia* (black locust), *Liquidambar styraciflua* (sweetgum), *Acer saccharinum* (silver maple), *Ulmus alata* (winged elm), *Ulmus rubra* (slippery elm), *Carya cordiformis* (bitternut hickory), *Fraxinus pennsylvanica* (green ash), *Juglans nigra* (black walnut), *Carpinus caroliniana* (American hornbeam), *Morus rubra* (red mulberry), and *Populus deltoides* (eastern cottonwood). The shrub and herb layers range from sparse to relatively lush, and the vine component often is heavy. The herb layer consists of a mixture of weedy exotics and native floodplain species.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This early-successional box-elder floodplain forest was sampled twice on the park. One site is a gently sloping, north-facing bottomland with poorly drained silt loam soil. The other is a flat seasonally flooded floodplain with well-drained sand soil. The unvegetated surface is made up entirely of leaf litter (100% cover). Evidence of disturbance includes seasonal flooding at one site and past agriculture (former pasture), barbed-wire fence, roads and trails, and the presence of exotic plants at the other.

Global Environment: Stands occur on large rivers in the active floodplain and on sandbars, and may form farther from the riverfront following disturbance. Occurrences are mostly on higher floodplain terraces with less rocky soils which were used for agriculture or habitation. They are typically temporarily flooded in the spring and have sandy soils. In Kentucky, these forests may also occur in old fields.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The moderate to closed (70-100% cover) tree canopy, 15-35 m tall, may be dominated exclusively by *Acer negundo* (box-elder) or also include *Celtis occidentalis* (common hackberry), *Fraxinus pennsylvanica* (green ash), and *Platanus occidentalis* (American sycamore). The sparse (0-20%) *Acer negundo* (box-elder) subcanopy (10-15 m), when present, also includes a small amount of *Gleditsia triacanthos* (honeylocust). There is almost no shrub layer, only 5% cover of short shrubs (0.5-1 m), including *Lindera benzoin* (northern spicebush) and *Prunus serotina* (black cherry). The dense (90%) herbaceous layer is strongly dominated by *Elymus virginicus* (Virginia wildrye) at one site and by *Chasmanthium latifolium* (Indian woodoats) at the other; other species found at very low to trace amounts include *Elephantopus carolinianus* (Carolina elephantsfoot), *Festuca subverticillata* (nodding fescue), *Laportea canadensis* (Canadian woodnettle), *Smilax rotundifolia* (roundleaf greenbrier), *Verbesina helianthoides* (gravelweed), *Viola sororia* (common blue violet), and many others.

Global Vegetation: These early-successional forests (sometimes woodlands) are dominated by *Acer negundo* (box-elder). Other characteristic species include *Platanus occidentalis* (American sycamore), *Celtis laevigata* (sugarberry), *Acer rubrum* (red maple), *Liriodendron tulipifera* (tuliptree), *Robinia pseudoacacia* (black locust), *Liquidambar styraciflua* (sweetgum), *Acer saccharinum* (silver maple), *Ulmus alata* (winged elm), *Ulmus rubra* (slippery elm), *Carya cordiformis* (bitternut hickory), *Fraxinus pennsylvanica* (green ash), *Juglans nigra* (black walnut), *Carpinus caroliniana* (American hornbeam), *Morus rubra* (red mulberry), and *Populus deltoides* (eastern cottonwood). The shrub and herb layers range from sparse to relatively lush, and the vine component often is heavy. *Lindera benzoin* (northern spicebush) may be dominant in the shrub layer. The herb layer consists of a mixture of weedy exotics and native floodplain species, including *Ageratina altissima* (white snakeroot), *Alliaria petiolata* (garlic mustard), *Boehmeria cylindrica* (small-spike false nettle), *Carex grayi* (Gray's sedge), *Cryptotaenia canadensis* (Canadian honewort), *Glechoma hederacea* (ground ivy), *Lysimachia nummularia* (creeping jenny), *Mertensia virginica* (Virginia bluebells), *Polygonum virginianum* (jumpseed), *Prunella vulgaris* (common selfheal), *Urtica dioica ssp. dioica* (stinging nettle), and *Verbesina alternifolia* (wingstem). The range, dynamics, and variability of this type are complicated by the "weedy" nature of *Acer negundo* (box-elder), e.g., in Kentucky, *Acer negundo* (box-elder) may be dominant in old fields, with *Dichanthelium clandestinum* (deertongue) and *Carex* (sedge) spp. in the ground layer. Elsewhere in the Midwest, logged and grazed stands of *Fraxinus pennsylvanica* (green ash) and *Ulmus americana* (American elm) may be dominated by *Acer negundo* (box-elder).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer negundo* (box-elder)
Herb (field)	Graminoid	*Chasmanthium latifolium* (Indian woodoats), *Elymus virginicus* (Virginia wildrye)

Global

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer negundo* (box-elder)

CHARACTERISTIC SPECIES

Buffalo National River: *Acer negundo* (box-elder), *Elymus virginicus* (Virginia wildrye)

Global: *Acer negundo* (box-elder), *Acer saccharinum* (silver maple), *Ageratina altissima* (white snakeroot), *Boehmeria cylindrica* (small-spike false nettle), *Carex grayi* (Gray's sedge), *Lindera benzoin* (northern spicebush), *Liquidambar styraciflua* (sweetgum),

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Mertensia virginica (Virginia bluebells), *Platanus occidentalis* (American sycamore), *Prunella vulgaris* (common selfheal), *Robinia pseudoacacia* (black locust), *Ulmus americana* (American elm), *Verbesina alternifolia* (wingstem)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Exotic/Invasive: *Ailanthus altissima* (tree of heaven, exotic, Medium), *Cynodon dactylon* (Bermudagrass, exotic, Medium/Low), *Lonicera japonica* (Japanese honeysuckle, exotic, High/Medium), *Melilotus officinalis* (yellow sweetclover, exotic, Medium/Low), *Perilla frutescens* (beefsteakplant, exotic, Low), *Stellaria media* (common chickweed, exotic, Low), *Torilis arvensis* (spreading hedgeparsley, exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (28-Mar-2003). As currently defined, this is a broad-ranging community type. However, the range, dynamics, and variability of this type are complicated by the "weedy" nature of *Acer negundo* (box-elder). More information may be needed to clarify the extent to which this type represents purely natural vegetation. Some stands may develop following disturbance of other natural bottomland communities.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: The range, dynamics, and variability of this type is complicated by the 'weedy' nature of *Acer negundo* (box-elder). For example, disturbed stands in the *Fraxinus pennsylvanica - Ulmus americana - Celtis (occidentalis*, *laevigata)* Temporarily Flooded Forest Alliance (A.286) often become dominated by *Acer negundo* (box-elder). And in the upper Midwest *Acer negundo* (box-elder)-dominated stands are treated as part of the *Fraxinus pennsylvanica - (Ulmus americana) / Symphoricarpos occidentalis* Forest (CEGL002088). Thus, some consistency is needed in the application of this type across its range. In Arkansas, these forests can be pure *Acer negundo* (box-elder) or have *Acer rubrum* (red maple) and *Platanus occidentalis* (American sycamore) as associates (T. Foti pers. comm. 1999). Composition is variable. This type occurs along the Arkansas River in Arkansas (D. Zollner pers. comm. 1999). In Missouri, stands would probably be combined with *Betula nigra - Platanus occidentalis* Forest (CEGL002086) (M. Leahy pers. comm. 1999). In Kentucky, this may be found at the Licking River impoundment (Cave Run Lake). Narrower floodplains of smaller rivers and streams are not included in this association but are treated instead under *Acer negundo - (Platanus occidentalis*, *Populus deltoides)* Forest (CEGL004690).
Global Similar Associations:
Acer negundo - (Platanus occidentalis, Populus deltoides) Forest (CEGL004690)
Betula nigra - Platanus occidentalis Forest (CEGL002086)
Fraxinus pennsylvanica - (Ulmus americana) / Symphoricarpos occidentalis Forest (CEGL002088)
Fraxinus pennsylvanica - Ulmus americana - (Acer negundo, Tilia americana) Northern Forest (CEGL002089)
Fraxinus pennsylvanica - Ulmus spp. - *Celtis occidentalis* Forest (CEGL002014)
Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra Forest (CEGL007334)
Global Related Concepts:
Acer negundo Forest (Harrison 2004) =
Acer negundo riparian woodland (Vanderhorst 2001b) =
Bottomland Hardwood Forest (Smith 1996a) >

ELEMENT DISTRIBUTION

Buffalo National River Range: This box-elder floodplain forest was sampled at Erbie Recreation Area and near Parker Hickman homestead.
Global Range: This *Acer negundo* (box-elder) floodplain forest is found sporadically on floodplains in the southern, eastern, and midwestern United States, ranging from New York and New Jersey west to Iowa (and possibly southeastern South Dakota), south to Louisiana and possibly Texas, and east to Georgia. It occurs in the Piedmont region in Pennsylvania and in the Coastal Plain and Piedmont regions in New Jersey and Delaware.
Nations: CA, US
States/Provinces: AL, AR, DC, DE:S3, GA, IA, KY, LA, MD, MO, MS, NJ, NY, OK, PA, QC:S4?, SC, SD?, TN, TX?, VA, WV
TNC Ecoregions: 31:?, 32:P, 36:P, 38:C, 39:C, 40:C, 41:P, 42:C, 43:C, 44:C, 50:C, 53:C, 56:?, 57:?, 58:?, 59:C, 61:C, 62:C
USFS Ecoregions (1994/95): 221Bc:CCC, 221Ha:CC?, 221Hc:CC?, 221Hd:CC?, 221He:CC?, 221Ja:CP?, 221Jb:CP?, 221Jc:CP?, 222An:CCC, 222Ca:CC?, 222Cb:CC?, 222Cd:CC?, 222Ce:CC?, 222Cf:CC?, 222Cg:CCC, 222Ch:CC?, 222Ea:CCP, 222Eb:CCP, 222Ec:CCP, 222Ed:CCP, 222Ee:CCP, 222Ef:CCP, 222Eg:CCC, 222Eh:CCP, 222Ei:CCP, 222Ej:CCP, 222Ek:CCP, 222En:CCP, 222Eo:CCC, 222Fa:CP?, 222Fb:CP?, 222Fc:CP?, 222Fd:CP?, 222Ff:CP?, 231Ba:CCC, 231Bb:CCP, 231Bc:CCP, 231Bd:CCP, 231Be:CCP, 231Bf:CCP, 231Bg:CCP, 231Bh:CCC, 231Bi:CCC, 231Bj:CCP, 231Bk:CCP, 231Bl:CCP, 231Ca:CCP, 231Cb:CCP, 231Cc:CCP, 231Cd:CCC, 231Ce:CCP, 231Cf:CCP, 231Cg:CCP, 231Da:CCP, 231Db:CCP, 231Dc:CCP, 231Dd:CCP, 231De:CCP, 231Ea:CC?, 231Eb:CCP, 231Ec:CC?, 231Ed:CCP, 231Ee:CCP, 231Ef:CCP, 231Eg:CCP, 231Eh:CCP, 231Ei:CCP, 231Ej:CCP, 231Ek:CCP, 231El:CCP, 231Em:CCP, 231En:CCP, 231Fa:C??, 231Fb:C??, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Ac:CCC, 232Bb:CCC, 232Bd:CCC, 234Aa:CCC, 234Ab:CCC, 234Ac:CCC, 234Ad:CCC, 234Ae:CCC, 234Af:CCC, 234Ag:CCC, 234Ah:CCC, 234Ai:CCC, 234Aj:CCC, 234Ak:CCC, 234Al:CCC, 234Am:CCC, 234An:CCC, M221Be:CCC, M221Cb:CCC

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Federal Lands: NPS (Antietam, Bluestone, Buffalo River, C&O Canal, Chickamauga-Chattanooga, George Washington Parkway, Harpers Ferry, Manassas, Monocacy, Natchez Trace, National Capital-East?, New River Gorge, Ozark Riverways, Saratoga, Shiloh, Vicksburg); USFS (Daniel Boone, St. Francis); USFWS (Little River)

ELEMENT SOURCES

Buffalo National River Plots: (2 plots): BUFF.216, BUFF.217.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: E. Largay and S.C. Gawler
References: Blair 1938, Campbell pers. comm., Chastain et al. 2006, Fleming et al. 2001, Foti pers. comm., Harrison 2004, Harrison 2011, Hoagland 2000, INAI unpubl. data, Lea 2004, Leahy pers. comm., NRCS 2004a, Nigh et al. 2000, Patterson and DeSelm 1989, Schotz pers. comm., Smith 1996a, Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2008, Zollner pers. comm.

Silver Maple - Elm Forest

***Acer saccharinum - Ulmus americana* Forest**
Silver Maple - American Elm Forest
Identifier: CEGL002586

NVC CLASSIFICATION

Division	Eastern North American Flooded & Swamp Forest (1.B.3.Na)
Macrogroup	Northern & Central Floodplain Forest & Scrub (M029)
Group	Silver Maple - Green Ash - Sycamore Floodplain (G040)
Association (Common name)	Silver Maple - Elm Forest

ELEMENT CONCEPT

Global Summary: This silver maple - elm - cottonwood forest is found throughout the midwestern United States and parts of the eastern United States. Stands occur on large, regularly flooded floodplains. The canopy cover is more-or-less closed and dominated by *Acer saccharinum* (silver maple). Codominants may include *Platanus occidentalis* (American sycamore), *Betula nigra* (river birch), and rarely *Acer saccharum* (sugar maple). Associated species may include *Ulmus americana* (American elm), *Ulmus rubra* (slippery elm), *Acer negundo* (box-elder), *Salix nigra* (black willow), *Celtis occidentalis* (common hackberry), *Carya cordiformis* (bitternut hickory), *Juglans nigra* (black walnut), and *Fraxinus pennsylvanica* (green ash). The shrub and sapling layer is often open (<25% cover). Species that may be present include *Sambucus canadensis* (common elderberry), *Rubus occidentalis* (black raspberry), or *Lindera benzoin* (northern spicebush). Woody and herbaceous vines can be prominent, including among the woody vines *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis riparia* (riverbank grape). Herbaceous vine species include *Apios americana* (groundnut), *Amphicarpaea bracteata* (American hogpeanut), and *Echinocystis lobata* (wild cucumber). Herbaceous grasses, forbs, and ferns dominate the ground layer, including *Symphyotrichum lateriflorum* (calico aster), *Boehmeria cylindrica* (small-spike false nettle), *Erythronium americanum* (dogtooth violet), *Solidago gigantea* (giant goldenrod), *Cinna arundinacea* (sweet woodreed), *Leersia virginica* (whitegrass), *Elymus virginicus* (Virginia wildrye), *Impatiens pallida* (pale touch-me-not), *Laportea canadensis* (Canadian woodnettle), *Matteuccia struthiopteris* (ostrich fern), *Onoclea sensibilis* (sensitive fern), *Pilea pumila* (Canadian clearweed), *Urtica dioica* (stinging nettle), and others. A variety of exotics may be present, including *Lysimachia* (yellow loosestrife) spp., *Microstegium vimineum* (Nepalese browntop), *Polygonum cuspidatum* (Japanese knotweed), *Rosa multiflora* (multiflora rose), and *Lonicera japonica* (Japanese honeysuckle).

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This silver maple - elm forest was sampled twice on the park. One site is a flat, temporarily flooded sand bar above a cobble bar of the Buffalo River with well-drained sand soil. The other is a somewhat steep, northwest-facing and temporarily flooded stream terrace with rapidly drained sand soil. The unvegetated surface is made up of leaf litter (20-70% cover), some wood (2-5%) and bare sand (28-60%). Evidence of disturbance includes hydrologic changes, erosion, and the presence of exotic plants.
Global Environment: This community occurs on temporarily flooded soils along major rivers and smaller perennial streams. Soils may be well-drained and sandy, more loamy on infrequently flooded bottomlands and levees, or deep silts on stabilized sites along larger rivers. It appears to be favored by deposition of deep sandy sediments by low-energy floodwaters. The community may form small linear patches among other floodplain associations or be locally extensive. The structure and composition of the type is influenced by the flooding regime. Floods leave river-deposited debris on the forest floor, ice scars on trees, and abandoned channels that retain water at or above the level of the main river channel.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The moderate (40-50% cover) tree canopy, 10-25 m tall, is dominated by *Acer saccharinum* (silver maple), sometimes along with *Carya cordiformis* (bitternut hickory), *Celtis occidentalis* (common hackberry), *Quercus rubra* (northern red oak), *Platanus occidentalis* (American sycamore), and *Fraxinus pennsylvanica* (green ash). The moderate (50%) subcanopy (5-10 m) is dominated by *Acer negundo* (box-elder) and canopy species. The moderate (50%) tall-shrub layer (2-5 m) and moderate (60%) short-shrub layer (0.5-1 m) are dominated by *Acer negundo* (box-elder) and *Arundinaria gigantea* (giant cane). The

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moderate (40-50%) herbaceous layer may be dominated by *Chasmanthium latifolium* (Indian woodoats), *Laportea canadensis* (Canadian woodnettle), and/or *Verbesina alternifolia* (wingstem), along with lesser amounts of *Campanulastrum americanum* (American bellflower), *Dichanthelium clandestinum* (deertongue), *Polygonum virginianum* (jumpseed), and *Rudbeckia laciniata* (cutleaf coneflower). Vines (up to 40% cover) may include *Aristolochia tomentosa* (woolly dutchman's pipe), *Cocculus carolinus* (Carolina coralbead), *Parthenocissus quinquefolia* (Virginia creeper), and *Toxicodendron radicans* (eastern poison-ivy), among others. This community also supports state-vulnerable *Stylophorum diphyllum* (celandine poppy).

Global Vegetation: The canopy cover is more-or-less closed and dominated by *Acer saccharinum* (silver maple). Codominants may include *Platanus occidentalis* (American sycamore), *Betula nigra* (river birch), and rarely *Acer saccharum* (sugar maple). Associated species may include *Ulmus americana* (American elm), *Ulmus rubra* (slippery elm), *Acer negundo* (box-elder), *Salix nigra* (black willow), *Celtis occidentalis* (common hackberry), *Carya cordiformis* (bitternut hickory), *Juglans nigra* (black walnut), *Fraxinus pennsylvanica* (green ash), and occasionally *Halesia tetraptera* (mountain silverbell). The shrub and sapling layer is often open (<25% cover). Species that may be present include *Sambucus canadensis* (common elderberry), *Rubus occidentalis* (black raspberry), or *Lindera benzoin* (northern spicebush). Woody and herbaceous vines can be prominent, including among the woody vines *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis riparia* (riverbank grape). Herbaceous vine species include *Apios americana* (groundnut), *Amphicarpaea bracteata* (American hogpeanut), and *Echinocystis lobata* (wild cucumber). Grasses, forbs, and ferns dominate the ground layer, including various combinations of *Symphyotrichum lateriflorum* (calico aster), *Boehmeria cylindrica* (small-spike false nettle), *Chasmanthium latifolium* (Indian woodoats), *Cryptotaenia canadensis* (Canadian honewort), *Erythronium americanum* (dogtooth violet), *Solidago gigantea* (giant goldenrod), *Cinna arundinacea* (sweet woodreed), *Leersia virginica* (whitegrass), *Elymus virginicus* (Virginia wildrye), *Helianthus* (sunflower) sp., *Impatiens capensis* (jewelweed), *Impatiens pallida* (pale touch-me-not), *Laportea canadensis* (Canadian woodnettle), *Matteuccia struthiopteris* (ostrich fern), *Menispermum canadense* (common moonseed), *Onoclea sensibilis* (sensitive fern), *Pilea pumila* (Canadian clearweed), *Polygonum virginianum* (jumpseed), *Rudbeckia laciniata* (cutleaf coneflower), *Verbesina alternifolia* (wingstem), *Urtica dioica* (stinging nettle), and others. A variety of exotics may be present, including *Lysimachia* (yellow loosestrife) spp., *Microstegium vimineum* (Nepalese browntop), *Glechoma hederacea* (ground ivy), *Polygonum cuspidatum* (Japanese knotweed), *Rosa multiflora* (multiflora rose), and *Lonicera japonica* (Japanese honeysuckle).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer saccharinum* (silver maple)
Tree subcanopy	Broad-leaved deciduous tree	*Acer negundo* (box-elder)
Shrub/sapling (tall & short)	Graminoid	*Arundinaria gigantea* (giant cane)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer negundo* (box-elder)
Herb (field)	Forb	*Verbesina alternifolia* (wingstem)
Herb (field)	Graminoid	*Chasmanthium latifolium* (Indian woodoats)

Global

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer saccharinum* (silver maple)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy)
Herb (field)	Graminoid	*Leersia virginica* (whitegrass)

CHARACTERISTIC SPECIES

Buffalo National River: *Acer negundo* (box-elder), *Acer saccharinum* (silver maple), *Arundinaria gigantea* (giant cane), *Chasmanthium latifolium* (Indian woodoats), *Verbesina alternifolia* (wingstem)

Global: *Acer negundo* (box-elder), *Acer saccharinum* (silver maple), *Alliaria petiolata* (garlic mustard), *Conium maculatum* (poison hemlock), *Elymus virginicus* (Virginia wildrye), *Glechoma hederacea* (ground ivy), *Humulus japonicus* (Japanese hop), *Populus deltoides* (eastern cottonwood), *Urtica dioica* ssp. *gracilis* (California nettle)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Stylophorum diphyllum* (celandine poppy, state-vulnerable, G5); **Exotic/Invasive**: *Ailanthus altissima* (tree of heaven, exotic, Medium), *Dioscorea oppositifolia* (Chinese yam, exotic, High/Medium), *Saponaria officinalis* (bouncingbet, exotic, Low/Insignificant)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (3-Oct-1996). There has been significant conversion of stands to agriculture, hydrologic modifications due to river dams, etc., and siltation caused by modified flooding regimes.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

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Global Comments: This type includes stands where *Acer saccharinum* (silver maple) represents the majority of trees (>50% cover or basal area?). This type is most clearly expressed on larger rivers. To some degree this type is more northern, separable from the more southern type *Acer saccharinum - Celtis laevigata - Carya illinoinensis* Forest (CEGL002431), but this distinction is not yet well resolved. In the southern parts of its range, this type may overlap with *Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra* Forest (CEGL007334), but that type is generally a higher terrace, small stream type. Compare this type with SAF cover type 62 (Eyre 1980). In Minnesota stands with less than either 50% cottonwood or silver maple and not in northwestern Minnesota tend to occur here (i.e., a mixed floodplain forest), as do silver maple stands with a supercanopy of cottonwoods. In southwestern Minnesota, stands with only some swamp white oak go here. If swamp white oak is dominant the stands probably belong with either an association in the *Quercus palustris - (Quercus bicolor)* Seasonally Flooded Forest Alliance (A.329), or *Quercus macrocarpa - Quercus bicolor - Carya laciniosa / Leersia* spp. - *Cinna* (woodreed) spp. Forest (CEGL002098), at least in the Midwest. *Fraxinus pennsylvanica* (green ash) is a typical codominant in this type. In Wisconsin, this type may better be named *Acer saccharinum - Fraxinus pennsylvanica - Betula nigra* Forest (E. Epstein pers. comm. 1999).

Global Similar Associations:

Acer (rubrum, saccharinum) - Fraxinus spp. - *Ulmus americana* Forest (CEGL005038) grades into this community in backwater swamps.

Acer saccharinum - (Populus deltoides) / Matteuccia struthiopteris - Laportea canadensis Forest (CEGL006147) is somewhat more northern, lacking *Platanus* and *Betula nigra*.

Acer saccharinum - Acer negundo / Ageratina altissima - Laportea canadensis - (Elymus virginicus) Forest (CEGL006217)

Acer saccharinum - Betula nigra / Cephalanthus occidentalis Forest (CEGL007810)

Acer saccharinum - Celtis laevigata - Carya illinoinensis Forest (CEGL002431) is more southern.

Acer saccharinum Temporarily Flooded Forest [Placeholder] (CEGL007304)

Fagus grandifolia - Quercus spp. - *Acer rubrum - Juglans nigra* Forest (CEGL005014) in the eastern part of its range on the mesic side.

Fraxinus pennsylvanica - Ulmus americana - (Acer negundo, Tilia americana) Northern Forest (CEGL002089) in the western part of its range on the mesic side.

Fraxinus pennsylvanica - Ulmus spp. - *Celtis occidentalis* Forest (CEGL002014)

Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra Forest (CEGL007334) may overlap in southern parts of the range of CEGL002586.

Populus deltoides - Salix nigra Forest (CEGL002018) grades into this community on the wetter side.

Quercus macrocarpa - Quercus bicolor - Carya laciniosa / Leersia spp. - *Cinna* spp. Forest (CEGL002098)

Global Related Concepts:

Floodplain Forest Silver Maple Subtype (MNNHP 1993) **<**
Floodplain Forest Silver Maple Subtype (Faber-Langendoen 2001) **=**
Floodplain Forest Swamp White Oak Subtype (MNNHP 1993) **<**
Silver Maple - American Elm: 62 (Eyre 1980) **>**
Silver maple-American elm-cottonwood floodplain forest (CAP pers. comm. 1998) **?**
Southern Floodplain Forest (Chapman et al. 1989) **>**
Wet Bottomland Forest (Nelson 1985) **>**

ELEMENT DISTRIBUTION

Buffalo National River Range: This silver maple - elm forest was sampled near Tyler Bend boat launch and at Dillard's Ferry.

Global Range: This association is found throughout the midwestern United States and in the mid-Atlantic region of the eastern United States, ranging from Delaware, New Jersey, and Pennsylvania west to Minnesota, and south to Arkansas.

Nations: CA, US

States/Provinces: AR, DE, IA:SU, IL, IN, KY, MI, MN, MO, NJ, NY, OH, ON, PA, QC, TN, WI:S3, WV:S3S4

TNC Ecoregions: 35:C, 36:C, 37:C, 38:C, 40:?, 42:C, 43:P, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:C, 60:C, 61:C, 62:C

USFS Ecoregions (1994/95): 212Fc:CCC, 212Hb:CCC, 212He:CCC, 212Hm:CCC, 212Ht:CCP, 212Hv:CCC, 212Hw:CCP, 212Hx:CCP, 212Hy:CCP, 212Ja:CCC, 212Je:CCC, 212Jf:CCC, 212Jj:CC?, 212Jl:CCC, 212Js:CCC, 212Ka:CC?, 212Kb:CCC, 212Mb:CPP, 212Na:CC?, 212Nb:CCP, 212Nc:CCC, 212Nd:CCC, 221Bd:CCC, 221Da:CCC, 221Db:CCC, 221Ea:CCC, 221Ec:CCC, 221Ed:CCC, 221Ef:CCC, 221Fa:CCC, 222Aj:CCC, 222An:CCC, 222Ap:CCC, 222Aq:CCC, 222Ch:CCC, 222Db:CCC, 222Dc:CCP, 222De:CCC, 222Df:CCP, 222Ei:CPP, 222Ek:CPP, 222El:CPP, 222Em:CPP, 222Fa:CCP, 222Fb:CCC, 222Fc:CCP, 222Fd:CCP, 222Fe:CCP, 222Ff:CCP, 222Ga:CCC, 222Gb:CCC, 222Gc:CCC, 222Gd:CCP, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222Hc:CCC, 222Hf:CCC, 222If:CCC, 222Jb:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ka:CCC, 222Kb:CCC, 222Kd:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCP, 222Lc:CCC, 222Ld:CCC, 222Lf:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 232Ac:CCC, 234Aa:CC?, 234Am:CCC, 234An:CCC, 251Ba:CCC, 251Be:CCC, 251Cc:CCC, 251Cd:CCC, 251Cf:CCC, 251Dd:CCP, 251De:CCC, 251Df:CCC, 251Dg:CCC, 251Dh:CCC, 251Eb:CCC, M221Cb:CCC

Federal Lands: NPS (Buffalo River, Cuyahoga Valley, Delaware Water Gap, Effigy Mounds, Indiana Dunes, New River Gorge, Saint Croix, Upper Delaware); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Huron-Manistee, Huron?, Manistee, Nicolet?, Ozark?, Wayne); USFWS (Erie)

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ELEMENT SOURCES

Buffalo National River Plots: (2 plots): BUFF.082, BUFF.120.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: D. Faber-Langendoen, mod. L.A. Sneddon, E. Largay, S.C. Gawler
References: Anderson 1996, CAP pers. comm. 1998, Chapman et al. 1989, Eyre 1980, Faber-Langendoen 2001, Fike 1999, Hop et al. 2005, Hop et al. 2009, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., Nelson 1985, Perles et al. 2007, Perles et al. 2008, Podniesinski and Wagner 2002, TDNH unpubl. data, Vanderhorst et al. 2007, WNHIP unpubl. data, WPC and TNC 2002, Walton et al. 1996

River Birch - Sycamore Small River Floodplain Forest

***Betula nigra - Platanus occidentalis* Forest**
River Birch - American Sycamore Forest
Identifier: CEGL002086

NVC CLASSIFICATION

Division	Eastern North American Flooded & Swamp Forest (1.B.3.Na)
Macrogroup	Northern & Central Floodplain Forest & Scrub (M029)
Group	Silver Maple - Green Ash - Sycamore Floodplain (G040)
Association (Common name)	River Birch - Sycamore Small River Floodplain Forest

ELEMENT CONCEPT

Global Summary: This river birch - sycamore forest community is found throughout the east-central United States. Stands commonly occur along stream and small riverbanks, shores of ponds, and in swampy forests. Alluvial soils which support this natural community are relatively deep, moist, well-drained, and often sandy on the surface. *Betula nigra* (river birch) and *Platanus occidentalis* (American sycamore) are the typical dominants. They are fast-growing, relatively short-lived, and do not tolerate excessive shade at any stage of growth. *Betula nigra* (river birch) prefers acidic soils and is often the dominant tree found along streams affected by acidic mine drainage. A wide range of canopy species are present, both common bottomland species (e.g., *Ulmus americana* (American elm), *Acer rubrum* (red maple), *Acer negundo* (box-elder), *Fraxinus pennsylvanica* (green ash), *Quercus* (oak) spp., and *Celtis laevigata* (sugarberry)) and mesophytic species from nearby uplands and terraces (e.g., *Juglans nigra* (black walnut), *Prunus serotina* (black cherry), and *Fraxinus americana* (white ash)). Vines that may reach into the canopy include *Toxicodendron radicans* (eastern poison-ivy) and *Vitis aestivalis var. bicolor* (summer grape). A variety of wetland species may be found on more poorly drained sites. Stands are subjected to frequent, fast, short-duration flooding, which contributes to a typically thin understory. Native species in the shrub layer include *Carpinus caroliniana ssp. virginiana* (American hornbeam), *Lindera benzoin* (northern spicebush), *Alnus serrulata* (hazel alder), and *Cornus amomum* (silky dogwood); the exotic *Rosa multiflora* (multiflora rose) may be prevalent at some sites. Commonly encountered herbaceous species include *Saururus cernuus* (lizard's-tail), *Amphicarpaea bracteata* (American hogpeanut), *Arisaema dracontium* (green dragon), *Boehmeria cylindrica* (small-spike false nettle), *Carex amphibola* (eastern narrowleaf sedge), *Glyceria striata* (fowl mannagrass), *Impatiens capensis* (jewelweed), *Leersia virginica* (whitegrass), *Onoclea sensibilis* (sensitive fern), *Symphyotrichum ontarionis* (bottomland aster), *Pilea pumila* (Canadian clearweed), *Polygonum virginianum* (jumpseed), *Verbesina alternifolia* (wingstem), and *Verbesina occidentalis* (yellow crownbeard). Exotic herbs are abundant at some sites and include *Lysimachia nummularia* (creeping jenny), *Alliaria petiolata* (garlic mustard), and *Urtica dioica ssp. dioica* (stinging nettle).

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This river birch - sycamore forest was sampled at five locations in the park. Sites include flat to gently sloping cobble and sand bars and alluvial terraces that are temporarily flooded. Soils are typically rapidly drained sand. The unvegetated surface is either dominated by leaf litter (1-85% cover) or small rocks (0-96%) and large rocks (0-57%), with some wood (0-2%) and bare sand (0-15%). Evidence of disturbance includes erosion, hydrologic alterations, bridge construction and the presence of many invasive exotic plant species.
Global Environment: *Betula nigra* (river birch) requires soils near field capacity throughout the year but is relatively intolerant of flooding. *Platanus occidentalis* (American sycamore) is also intolerant of flooding during the growing season and will die if the entire tree is inundated for more than two weeks. The absence of this community in the lower Mississippi River Alluvial Plain is attributed to this intolerance, as is its most common location on levees of smaller rivers. Depending on hydroperiod, the community may be found on natural levees or on flats behind the levee. The community is more common along small streams and blackwater streams than along alluvial floodplains, largely because of the higher sustained flow rates of these larger rivers. It is also found along flowages of larger rivers. Along the Bluestone River in West Virginia, where the community is influenced by reservoir backup as well as the usual seasonal flooding, soils in plots are described as temporarily flooded, deep, dark-colored, poorly to well-drained silty loam and sandy loam derived from alluvium. Hydric soil indicators include saturated soil, high water table, low soil chroma, and oxidation-reduction features. Soils from plots tested extremely to strongly acidic (mean pH = 4.87) with relatively high levels of organic matter, estimated N release, S, B, Ca, Cu, Fe, Mg, Na, P, and Zn, and relatively low levels of Al, K, and Mn, compared to average values in the area.

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VEGETATION DESCRIPTION

Buffalo National River Vegetation: While this association typically occurs as a forest, a few examples here appear more as shrublands. The very sparse to dense (5-80% cover) tree canopy (5-20 m tall) is dominated by *Platanus occidentalis* (American sycamore); additional tree species may include *Acer negundo* (box-elder), *Betula nigra* (river birch), *Liquidambar styraciflua* (sweetgum), and *Ulmus americana* (American elm). Only one stand contains a sparse (40%) but diverse subcanopy (10-15 m) dominated by *Acer negundo* (box-elder). The sparse to moderate (30-60%) tall-shrub layer (2-5 m) is comprised of canopy species, as is the very sparse to moderate (5-50%) short-shrub layer (0.5-1 m), which may also include *Arundinaria gigantea* (giant cane) (dominates one stand), *Diospyros virginiana* (common persimmon), and *Symphoricarpos orbiculatus* (coralberry), among others. Common species in the herbaceous layer (30-80%) may include *Ambrosia artemisiifolia* (annual ragweed), *Chasmanthium latifolium* (Indian woodoats) (often dominant), *Dichanthelium clandestinum* (deertongue), *Laportea canadensis* (Canadian woodnettle), *Rudbeckia laciniata* (cutleaf coneflower), *Schizachyrium scoparium* (little bluestem), *Solidago arguta* (Atlantic goldenrod), and Verbesina virginica. Vines (0-10%) may include *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis* (grape) spp. Fifteen exotic species were recorded from the sampled plots.

Global Vegetation: *Betula nigra* (river birch) and *Platanus occidentalis* (American sycamore) are the typical dominants in this association with other disturbance-tolerant, wetland indicator species. They are fast-growing (especially as young trees), relatively short-lived, and do not tolerate excessive shade at any stage of growth. *Betula nigra* (river birch) prefers acidic soils and is often the dominant tree found along streams affected by acidic mine drainage. A wide range of canopy species are present, both common bottomland species (e.g., *Ulmus americana* (American elm), *Acer rubrum* (red maple), *Acer negundo* (box-elder), *Fraxinus pennsylvanica* (green ash), *Quercus* (oak) spp., and *Celtis laevigata* (sugarberry)) and mesophytic species from nearby uplands and terraces (e.g., *Juglans nigra* (black walnut), *Prunus serotina* (black cherry), and *Fraxinus americana* (white ash)). Vines that may reach into the canopy include *Toxicodendron radicans* (eastern poison-ivy) and *Vitis aestivalis var. bicolor* (summer grape). A variety of wetland species may be found on more poorly drained sites. Stands are subjected to frequent, fast, short-duration flooding, which contributes to a typically thin understory. Native species in the shrub layer include *Carpinus caroliniana ssp. virginiana* (American hornbeam), *Lindera benzoin* (northern spicebush), *Alnus serrulata* (hazel alder), and *Cornus amomum* (silky dogwood); the exotic *Rosa multiflora* (multiflora rose) may be prevalent at some sites. Commonly encountered herbaceous species include *Saururus cernuus* (lizard's-tail), *Amphicarpaea bracteata* (American hogpeanut), *Arisaema dracontium* (green dragon), *Boehmeria cylindrica* (small-spike false nettle), *Carex amphibola* (eastern narrowleaf sedge), *Glyceria striata* (fowl mannagrass), *Impatiens capensis* (jewelweed), *Leersia virginica* (whitegrass), *Onoclea sensibilis* (sensitive fern), *Symphyotrichum ontarionis* (bottomland aster), *Pilea pumila* (Canadian clearweed), *Polygonum virginianum* (jumpseed), *Verbesina alternifolia* (wingstem), and *Verbesina occidentalis* (yellow crownbeard). Exotic herbs are abundant at some sites and include *Lysimachia nummularia* (creeping jenny), *Alliaria petiolata* (garlic mustard), and *Urtica dioica ssp. dioica* (stinging nettle). This forest harbors a number of ubiquitous species and tends to extend into and mix with adjacent communities, resulting in numerous transitional variants. Occurrences may have a rather high percentage of standing dead trees. There may be remnant snags from previous earlier successional communities of cottonwood - black willow forests (TNC 1995a).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer negundo* (box-elder), *Liquidambar styraciflua* (sweetgum), *Platanus occidentalis* (American sycamore)
Shrub/sapling (tall & short)	Vine/Liana	*Toxicodendron radicans* (eastern poison-ivy)
Herb (field)	Forb	*Laportea canadensis* (Canadian woodnettle)
Herb (field)	Graminoid	*Chasmanthium latifolium* (Indian woodoats)

Global

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Betula nigra* (river birch), *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree), *Platanus occidentalis* (American sycamore), *Populus deltoides* (eastern cottonwood)
Tree subcanopy	Broad-leaved deciduous tree	*Carpinus caroliniana* (American hornbeam), *Salix nigra* (black willow)
Shrub/sapling (tall & short)	Vine/Liana	*Berchemia scandens* (Alabama supplejack), *Campsis radicans* (trumpet creeper), *Toxicodendron radicans* (eastern poison-ivy), *Vitis riparia* (riverbank grape)
Tall shrub/sapling	Broad-leaved deciduous tree	*Asimina triloba* (pawpaw)
Herb (field)	Forb	*Boehmeria cylindrica* (small-spike false nettle), *Geranium maculatum* (spotted geranium), *Impatiens capensis* (jewelweed), *Laportea canadensis* (Canadian woodnettle)

CHARACTERISTIC SPECIES

Buffalo National River: *Betula nigra* (river birch), *Platanus occidentalis* (American sycamore)

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OTHER NOTEWORTHY SPECIES

Buffalo National River: Exotic/Invasive: *Albizia julibrissin* (silktree, exotic, High/Low), *Alliaria petiolata* (garlic mustard, exotic, High/Medium), *Chenopodium album* (lambsquarters, exotic), *Chenopodium ambrosioides* (Mexican tea, exotic), *Cynodon dactylon* (Bermudagrass, exotic, Medium/Low), *Dioscorea oppositifolia* (Chinese yam, exotic, High/Medium), *Kickxia elatine* (sharpleaf cancerwort, exotic), *Kummerowia stipulacea* (Korean clover, exotic, Low), *Lespedeza cuneata* (sericea lespedeza, exotic, Medium), *Microstegium vimineum* (Nepalese browntop, exotic, High/Medium), *Perilla frutescens* (beefsteakplant, exotic, Low), *Polygonum persicaria* (spotted ladysthumb, exotic), *Rumex crispus* (curly dock, exotic, Low/Insignificant), *Saponaria officinalis* (bouncingbet, exotic, Low/Insignificant), *Verbascum thapsus* (common mullein, exotic, Medium)
Global: Other: *Ambystoma maculatum* (spotted salamander, G5), *Buteo lineatus* (red-shouldered hawk, G5), *Corythucha ciliata* (sycamore lace bug, GNR), *Dryocopus pileatus* (pileated woodpecker, G5), *Empidonax virescens* (acadian flycatcher, G5), *Neovison vison* (american mink, G5), *Nerodia erythrogaster erythrogaster* (redbelly watersnake, G5T5), *Nerodia erythrogaster flavigaster* (yellowbelly watersnake, G5T5), *Parkesia motacilla* (louisiana waterthrush, G5), *Parula americana* (northern parula, G5), *Procyon lotor* (raccoon, G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (22-Jun-1998). The community is widespread and common.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Buffalo National River Comments: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.
Global Comments: As currently described, this association and *Betula nigra - Platanus occidentalis / Alnus serrulata / Boehmeria cylindrica* Forest (CEGL007312) appear to be conceptually overlapping regional variants (north versus south). These two defined associations need to be reconciled. In Kentucky, this association (CEGL002086) would be found on the northern part of Daniel Boone National Forest, in contrast to CEGL007312, which is more southern. Other bottomland hardwood communities contain river birch in the canopy but at lower densities. It may be helpful to require that *Betula nigra* (river birch) contribute at least 50% (80%?) of the tree density to be placed in this community. This forest harbors a number of ubiquitous species and tends to extend into and mix with adjacent communities, resulting in numerous transitional variants. Both *Betula nigra* (river birch) and *Platanus occidentalis* (American sycamore) are also associated with highly disturbed sites: the former with coal mine drainage, and the latter with strip mine sites. The community described herein is naturally occurring on largely undisturbed sites, although it may occur under an artificial flooding regime created by reservoir backup (e.g., the Bluestone River in West Virginia). Backwater stands of *Betula nigra* (river birch) have also been observed along other West Virginia waterways, but the natural status of hydroperiods affecting these stands has not been determined. Along the Bluestone, Gauley, and New rivers, *Betula nigra* (river birch) is also an important component of *Platanus occidentalis - Betula nigra / Cornus amomum / (Andropogon gerardii*, *Chasmanthium latifolium)* Woodland (CEGL003725), which occurs along river shorelines subject to frequent high-energy flooding.
Global Similar Associations:
Acer negundo Forest (CEGL005033)
Betula nigra - Acer rubrum - (Liquidambar styraciflua, Platanus occidentalis) Successional Forest (CEGL006976)
Betula nigra - Platanus occidentalis / Alnus serrulata / Boehmeria cylindrica Forest (CEGL007312)
Betula nigra - Platanus occidentalis / Impatiens capensis Forest (CEGL006184)
Platanus occidentalis - Betula nigra / Cornus amomum / (Andropogon gerardii, Chasmanthium latifolium) Woodland (CEGL003725)
Global Related Concepts:
Acer negundo - Platanus / Rhus [Toxicodendron] radicans community (Voigt and Mohlenbrock 1964) **?**
Betula nigra - Acer saccharinum / Pilea community (Voigt and Mohlenbrock 1964) =
Betula nigra - Platanus occidentalis Forest (Fleming et al. 2006) =
Platanus occidentalis - Betula nigra Forest (Walton et al. 1997) **?**
Eastern Broadleaf Forests (Kuchler 1964) >
IIA7b. River Birch - Sycamore Riverfront Forest (Allard 1990) =
Palustrine: Forested Wetland: Riparian (TNC 1985) >
Palustrine: Palustrine Forested Wetland (Cowardin et al. 1979) >
Piedmont / Mountain Floodplain Forest (Fleming et al. 2001) >
R13cII4a. *Betula nigra - Platanus occidentalis* (Foti et al. 1994) **?**
River Birch - Red Maple, HR (Pyne 1994) **?**
River Birch - Sycamore: 61 (Eyre 1980) =
River Birch Floodplain Forests (Anderson 1996) =
UNESCO FORMATION CODE: I.B.3d (UNESCO 1973) >
Wet Bottomland Forest (Nelson 1985) >

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ELEMENT DISTRIBUTION

Buffalo National River Range: This association was sampled at Maumee South, near Chimney Rock Bluff, Buffalo Point and Arnold Bend.
Global Range: This river birch - sycamore forest community is found throughout the east-central United States, ranging from south-central Ohio west to Iowa, south to Arkansas and Mississippi, and east to West Virginia.
Nations: CA?, US
States/Provinces: AR, IA:SU, IL, IN, KY, MO, OH:S4, OK, ON?, TN, VA:SU, WV
TNC Ecoregions: 36:P, 37:P, 38:C, 39:C, 42:P, 44:C, 45:C, 48:C, 49:C, 50:C, 59:C
USFS Ecoregions (1994/95): 221Ea:CCC, 221Ec:CCC, 221Ed:CCP, 221Ef:CCC, 221Eg:CCC, 221Fa:CCC, 221Fc:CCC, 221Ha:CCC, 221He:CCC, 222Ad:CCP, 222Ae:CCP, 222Af:CCC, 222An:CCP, 222Ca:C??, 222Ch:C??, 222En:CCC, 222Eo:CCC, 222Ga:CCC, 222Ha:CCC, 222If:CCC, 231:P, 232:P, 234A:PP, 251:?, M221Be:CCC, M221Cd:CCC, M222Aa:PPP, M231:P
Federal Lands: NPS (Bluestone, Buffalo River, Prince William); USFS (Daniel Boone, Ouachita, Ouachita (Mountains), Ozark, Shawnee?, Wayne)

ELEMENT SOURCES

Buffalo National River Plots: (5 plots): BUFF.191, BUFF.192, BUFF.226, BUFF.724, BUFF.748.
Local Description Authors: M.J. Russo
Global Description Authors: S. Landaal, mod. S.C. Gawler
References: Allard 1990, Anderson 1996, Blair and Hubbell 1938, Braun 1950, Bruner 1931, Burns and Honkala 1990b, Campbell 1988, Campbell 1989a, Clark and Benforado 1980, Clark and Hutchinson 1994, Cowardin et al. 1979, Dickson and Segelquist 1978, Duever and Brinson 1984a, Evans 1991, Eyre 1980, Faulkner and Patrick n.d., Fleming and Patterson 2011a, Fleming et al. 2001, Fleming et al. 2006, Flinchum 1977, Foti 1994a, Foti 1994b, Foti et al. 1994, Fralish 1987, Fralish 1988b, Fralish et al. 1991, Gettman 1974, Hoagland 2000, INAI unpubl. data, Illinois Nature Preserve Commission 1973, Klimas et al. 1981, Kuchler 1964, McNab and Avers 1994, McWilliams and Rosson 1990, Merz 1958, Midwestern Ecology Working Group n.d., Miller and Tehon 1929, Nelson 1985, ONHD unpubl. data, Pell and Rettig 1983, Powell 1985, Putnam 1951, Putnam et al. 1960, Pyne 1994, SAF 1967, Schafale and Weakley 1990, TDNH unpubl. data, TNC 1985, TNC 1995a, Thornbury 1965, UNESCO 1973, Vanderhorst et al. 2008, Voigt and Mohlenbrock 1964, Walton et al. 1997, Wharton 1978, Wharton et al. 1982, White and Madany 1978, Wistendahl 1980

Ash - Oak - Sycamore Mesic Bottomland Forest

***Fraxinus pennsylvanica* - *Celtis* spp. - *Quercus* spp. - *Platanus occidentalis* Bottomland Forest**
Green Ash - Hackberry species - Oak species - American Sycamore Bottomland Forest
Identifier: CEGL002410

NVC CLASSIFICATION

Division	Eastern North American Flooded & Swamp Forest (1.B.3.Na)
Macrogroup	Northern & Central Floodplain Forest & Scrub (M029)
Group	Silver Maple - Green Ash - Sycamore Floodplain (G040)
Association (Common name)	Ash - Oak - Sycamore Mesic Bottomland Forest

ELEMENT CONCEPT

Global Summary: This ash - oak - sycamore mesic bottomland forest is found in Arkansas, Missouri and possibly other parts of the southeastern United States. Stands occur on level to gently sloping terraces and levees of stream and river floodplains, typically on larger streams. Soils are moderately well-drained and moist throughout the year, but only wet in spring. Ponding is typically absent. The species in the dominant tree layer include *Celtis occidentalis* (common hackberry), *Fraxinus pennsylvanica* (green ash), *Platanus occidentalis* (American sycamore), *Quercus macrocarpa* (bur oak) (or more rarely *Quercus alba* (white oak)). *Laportea canadensis* (Canadian woodnettle) is common in the ground layer.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This green ash forest was sampled at six locations in the park. Sites range from flat to somewhat steep stream terraces that are subject to occasional temporary flooding. The soils are well-drained to somewhat poorly drained sand, sandy loam and clay loam. The unvegetated surface is made up of leaf litter (5-65% cover), high-water woody debris (1-80%) and bare soil (15-74%). Evidence of disturbance includes flooding during periods of high water and the presence of exotic plants.
Global Environment: Stands of this forest association occur on level to gently sloping terraces and levees of stream and river floodplains, typically on larger streams. Soils are moderately well-drained and moist throughout the year, but only wet in spring. Ponding is typically absent (Nelson 1985).

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The sparse to dense (30-80% cover) tree canopy, 10-35 m tall, is dominated by *Carya cordiformis* (bitternut hickory), *Celtis occidentalis* (common hackberry), *Liquidambar styraciflua* (sweetgum), or *Fraxinus pennsylvanica* (green ash), as is the sparse to moderately dense (30-70%) subcanopy (5-15 m), which may also include *Maclura*

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pomifera (osage orange) and *Ulmus americana* (American elm). The sparse (5-40%) tall-shrub layer (2-5 m) may include *Acer negundo* (box-elder), *Asimina triloba* (pawpaw), *Carya cordiformis* (bitternut hickory), *Celtis occidentalis* (common hackberry), *Lindera benzoin* (northern spicebush), *Morus rubra* (red mulberry), *Sambucus canadensis* (common elderberry), and *Ulmus americana* (American elm); the sparse (5-30%) short-shrub layer (0.5-1 m) is made up of tall-shrub species as well as *Symphoricarpos orbiculatus* (coralberry). The sparse to entirely covered (40-100%) herbaceous layer (1-2 m) may be dominated by *Laportea canadensis* (Canadian woodnettle), *Elymus macgregorii*, or *Verbesina alternifolia* (wingstem); other common species include *Ambrosia trifida* (great ragweed), *Diclitera brachiata* (branched foldwing), *Parthenocissus quinquefolia* (Virginia creeper), *Rudbeckia laciniata* (cutleaf coneflower), and several exotic species.

Global Vegetation: The species in the dominant tree layer include *Celtis occidentalis* (common hackberry), *Fraxinus pennsylvanica* (green ash), *Platanus occidentalis* (American sycamore), *Quercus macrocarpa* (bur oak) (or more rarely *Quercus alba* (white oak)). *Laportea canadensis* (Canadian woodnettle) is common in the ground layer.

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Carya cordiformis* (bitternut hickory), *Celtis occidentalis* (common hackberry)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Acer negundo* (box-elder), *Asimina triloba* (pawpaw), *Ulmus americana* (American elm)
Short shrub/sapling	Broad-leaved deciduous shrub	*Symphoricarpos orbiculatus* (coralberry)

CHARACTERISTIC SPECIES

Buffalo National River: *Acer negundo* (box-elder), *Asimina triloba* (pawpaw), *Carya cordiformis* (bitternut hickory), *Celtis occidentalis* (common hackberry), *Fraxinus pennsylvanica* (green ash), *Symphoricarpos orbiculatus* (coralberry), *Ulmus americana* (American elm)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Exotic/Invasive: *Ailanthus altissima* (tree of heaven, exotic, Medium), *Alliaria petiolata* (garlic mustard, exotic, High/Medium), *Chenopodium album* (lambsquarters, exotic), *Dioscorea oppositifolia* (Chinese yam, exotic, High/Medium), *Ligustrum sinense* (Chinese privet, exotic, High/Medium), *Lonicera japonica* (Japanese honeysuckle, exotic, High/Medium), *Microstegium vimineum* (Nepalese browntop, exotic, High/Medium), *Perilla frutescens* (beefsteakplant, exotic, Low), *Poa pratensis* (Kentucky bluegrass, exotic, Medium), *Torilis arvensis* (spreading hedgeparsley, exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (31-Mar-2000). Most sites have been cleared for agriculture (M. Leahy pers. comm. 1999).

CLASSIFICATION

Status: Standard

Classification Confidence: 3 - Weak

Global Comments: See similar concept of bottomland forest *Fraxinus pennsylvanica - Celtis occidentalis - Tilia americana - (Quercus macrocarpa)* Forest (CEGL002081), but that type is in an upland formation. Compare to *Acer (saccharum, barbatum) - Quercus rubra - Carya cordiformis / Asimina triloba* Forest (CEGL002060), which occurs on smaller streams. More information on this type in Missouri is available from T. Nigh (pers. comm. 1998).

Global Similar Associations:

Acer (saccharum, barbatum) - Quercus rubra - Carya cordiformis / Asimina triloba Forest (CEGL002060)
Fraxinus pennsylvanica - Celtis occidentalis - Tilia americana - (Quercus macrocarpa) Forest (CEGL002081)
Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra Forest (CEGL007334)

Global Related Concepts:

Mesic Bottomland Forest (Nelson 1985) >

ELEMENT DISTRIBUTION

Buffalo National River Range: This green ash bottomland forest was sampled near the picnic area at Tyler Bend, along Richland Creek, and near Arnold Bend.

Global Range: This ash - oak - sycamore mesic bottomland forest is found in Arkansas, Missouri and possibly other parts of the southeastern United States.

Nations: US

States/Provinces: AR, MO

TNC Ecoregions: 37:C, 38:C

USFS Ecoregions (1994/95): 222Ac:CCC, 222Ad:CCC, 222Ae:CCC, 222Af:CCC, 222Aj:CCC, 222Ak:CCC, 222Am:CCC, 222An:CCC, 251Cd:CPP, 251Eb:CCC

Federal Lands: NPS (Buffalo River, Ozark Riverways); USFS (Mark Twain)

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ELEMENT SOURCES

Buffalo National River Plots: (6 plots): BUFF.124, BUFF.734, BUFF.735, BUFF.746, BUFF.747, BUFF.749.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: D. Faber-Langendoen
References: Chastain et al. 2006, Leahy pers. comm., Midwestern Ecology Working Group n.d., Nelson 1985, Nigh et al. 2000

Southern Green Ash - Elm - Sugarberry Forest

***Fraxinus pennsylvanica - Ulmus americana - Celtis laevigata / Ilex decidua* Forest**
Green Ash - American Elm - Sugarberry / Possum-haw Forest
Identifier: CEGL002427

NVC CLASSIFICATION

Division	Eastern North American Flooded & Swamp Forest (1.B.3.Na)
Macrogroup	Northern & Central Floodplain Forest & Scrub (M029)
Group	Silver Maple - Green Ash - Sycamore Floodplain (G040)
Association (Common name)	Southern Green Ash - Elm - Sugarberry Forest

ELEMENT CONCEPT

Global Summary: This green ash - American elm - sugarberry community is found throughout the central and southern United States. Stands occur in floodplains of major rivers where water is absent for most of the growing season. Soils are moist alluvial clay or silt loams. *Ulmus americana* (American elm) was once the most prominent member of this forest, but Dutch elm disease (*Ceratostomella ulmi*) and logging have eliminated many of the largest mature *Ulmus* (elm) spp. from most of the species natural range. *Fraxinus pennsylvanica* (green ash) dominates on moist flats and shallow sloughs, while *Celtis laevigata* (sugarberry) is most prevalent on new land or front sites. Other species commonly encountered include *Carya aquatica* (water hickory), *Quercus lyrata* (overcup oak), *Liquidambar styraciflua* (sweetgum), and *Acer negundo* (box-elder). The subcanopy is often dense and dominated by *Fraxinus pennsylvanica* (green ash) which sprouts prolifically. Shrubs typical of this forest include *Cornus drummondii* (roughleaf dogwood), *Ilex decidua* (possum-haw), and *Crataegus* (hawthorn) spp. The herbaceous layer is dense and diverse, dominated by *Galium* (bedstraw) spp., *Viola* (violet) spp., *Carex* (sedge) spp., *Leersia* (cutgrass) spp., *Boehmeria cylindrica* (small-spike false nettle), *Laportea canadensis* (Canadian woodnettle), *Pilea pumila* (Canadian clearweed), *Impatiens capensis* (jewelweed), and *Impatiens pallida* (pale touch-me-not). Vines most often encountered include *Toxicodendron radicans* (eastern poison-ivy), *Campsis radicans* (trumpet creeper), and *Parthenocissus quinquefolia* (Virginia creeper).

ENVIRONMENTAL DESCRIPTION

Global Environment: This community occurs in floodplains of major rivers, generally alluvial or brownwater rivers, on low ridges, flats, and sloughs; terrace flats and sloughs; and occasionally on new lands or fronts. In terms of hydrology, this is a Zone IV community (Wharton et al. 1982). Soils are clay or silt loams that are seasonally inundated or saturated for 1 or 2 months during the growing season, with a 50-100% annual frequency (Eyre 1980, Smith and Craig 1990). Alluvial deposition and nutrient input occurs, but less than in more frequently flooded forest types (Schafale and Weakley 1990).

VEGETATION DESCRIPTION

Global Vegetation: This community is a broadleaf deciduous floodplain forest which exhibits high canopy diversity and good herbaceous diversity (although lower herbaceous diversity than mesic floodplain forest). *Ulmus americana* (American elm) was once the most prominent member of this forest, but Dutch elm disease (*Ceratostomella ulmi*) and logging have eliminated many of the largest mature *Ulmus* (elm) spp. from most of the species natural range (Collingwood and Brush 1984). *Fraxinus pennsylvanica* (green ash) dominates on moist flats and shallow sloughs, while *Celtis laevigata* (sugarberry) is most prevalent on new land or front sites. Other species commonly encountered include *Carya aquatica* (water hickory), *Quercus lyrata* (overcup oak), *Liquidambar styraciflua* (sweetgum), and *Acer negundo* (box-elder). The subcanopy is often dense and dominated by *Fraxinus pennsylvanica* (green ash) which sprouts prolifically. *Fraxinus pennsylvanica* (green ash), however, is considered a pioneer species and does not maintain its canopy position under intense shading found in later successional stages (Voigt and Mohlenbrock 1964). Shrubs typical of this forest include *Cornus drummondii* (roughleaf dogwood), *Ilex decidua* (possum-haw), and *Crataegus* (hawthorn) spp. The herbaceous layer is dense and diverse, dominated by *Galium* (bedstraw) spp., *Viola* (violet) spp., *Carex* (sedge) spp., *Leersia* (cutgrass) spp., *Boehmeria cylindrica* (small-spike false nettle), *Laportea canadensis* (Canadian woodnettle), *Pilea pumila* (Canadian clearweed), *Impatiens capensis* (jewelweed), and *Impatiens pallida* (pale touch-me-not). Vines most often encountered include *Toxicodendron radicans* (eastern poison-ivy), *Campsis radicans* (trumpet creeper), and *Parthenocissus quinquefolia* (Virginia creeper) (TNC 1995a).

MOST ABUNDANT SPECIES

Global

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Celtis laevigata* (sugarberry), *Fraxinus pennsylvanica* (green ash), *Ulmus americana* (American elm)

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Tree canopy	Broad-leaved deciduous tree	*Carya aquatica* (water hickory), *Quercus lyrata* (overcup oak), *Quercus nigra* (water oak), *Quercus phellos* (willow oak)
Shrub/sapling (tall & short)	Vine/Liana	*Campsis radicans* (trumpet creeper), *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy)
Tall shrub/sapling	Broad-leaved deciduous tree	*Cornus drummondii* (roughleaf dogwood), *Ilex decidua* (possum-haw)

OTHER NOTEWORTHY SPECIES

Global: Vulnerable: *Macrochelys temminckii* (alligator snapping turtle, G3G4), *Vermivora bachmanii* (bachman's warbler, GH); **Other**: *Acris gryllus* (southern cricket frog, G5), *Agkistrodon piscivorus* (cottonmouth, G5), *Aix sponsa* (wood duck, G5), *Ambystoma maculatum* (spotted salamander, G5), *Ardea alba* (great egret, G5), *Ardea herodias* (great blue heron, G5), *Buteo brachyurus* (short-tailed hawk, G4G5), *Buteo lineatus* (red-shouldered hawk, G5), *Butorides virescens* (green heron, G5), *Coccyzus americanus* (yellow-billed cuckoo, G5), *Dendroica dominica* (yellow-throated warbler, G5), *Didelphis virginiana* (virginia opossum, G5), *Egretta caerulea* (little blue heron, G5), *Euphagus carolinus* (rusty blackbird, G4), *Gallinago gallinago* (common snipe, G5), *Hyla avivoca* (bird-voiced treefrog, G5), *Hyla cinerea* (green treefrog, G5), *Ictinia mississippiensis* (mississippi kite, G5), *Limenitis archippus* (viceroy, G5), *Limnothlypis swainsonii* (swainson's warbler, G4), *Lithobates sphenocephalus* (southern leopard frog, G5), *Lontra canadensis* (north american river otter, G5), *Megaceryle alcyon* (belted kingfisher, G5), *Melanerpes carolinus* (red-bellied woodpecker, G5), *Melanerpes erythrocephalus* (red-headed woodpecker, G5), *Mniotilta varia* (black-and-white warbler, G5), *Mycteria americana* (wood stork, G4), *Myiarchus crinitus* (great crested flycatcher, G5), *Neovison vison* (american mink, G5), *Nycticorax nycticorax* (black-crowned night-heron, G5), *Nymphalis antiopa* (mourning cloak, G5), *Odocoileus virginianus* (white-tailed deer, G5), *Oryzomys palustris* (marsh oryzomys, G5), *Parula americana* (northern parula, G5), *Peromyscus gossypinus* (cotton deermouse, G5), *Phalacrocorax auritus* (double-crested cormorant, G5), *Polioptila caerulea* (blue-gray gnatcatcher, G5), *Procyon lotor* (raccoon, G5), *Quiscalus quiscula* (common grackle, G5), *Reithrodontomys humulis* (eastern harvest mouse, G5), *Scolopax minor* (american woodcock, G5), *Setophaga ruticilla* (american redstart, G5), *Sigmodon hispidus* (hispid cotton rat, G5), *Sthenopis thule* (a ghost moth, GNR), *Strix varia* (barred owl, G5), *Sylvilagus aquaticus* (swamp rabbit, G5), *Sylvilagus palustris* (marsh rabbit, G5), *Vireo olivaceus* (red-eyed vireo, G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (15-Aug-1997).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: The Southeast Regional Office is in the process of describing the Mississippi River Alluvial Plain portion of this type, which includes southern Illinois, as a separate type.

Global Similar Associations:

Acer (rubrum, saccharinum) - Fraxinus spp. - *Ulmus americana* Forest (CEGL005038) is often non-floodplain.
Acer saccharinum - Celtis laevigata - Carya illinoinensis Forest (CEGL002431)
Fraxinus pennsylvanica - Ulmus spp. - *Celtis occidentalis* Forest (CEGL002014)
Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra Forest (CEGL007334)

Global Related Concepts:

Bottomland Hardwood Forest (Smith 1996a) **>**
Brownwater Levee Forest (Medium Levee Subtype) (Schafale 2000) **?**
Eastern Broadleaf and Needleleaf Forests: 113: Southern Floodplain Forest (*Quercus-Nyssa-Taxodium*) (Kuchler 1964) **>**
IIA6d. Sugarberry - American Elm - Green Ash Bottomland Forest (Allard 1990) **>**
P1B3cIV9a. *Celtis laevigata - Fraxinus pennsylvanica - Ulmus americana* (Foti et al. 1994) **?**
Palustrine: Palustrine Forested Wetland (Cowardin et al. 1979) **<**
Sugarberry - American Elm - Green Ash: 93 (Eyre 1980) **>**
Terrestrial: Forest: Hardwood (TNC 1985) **>**
UNESCO FORMATION CODE: I.B.3d (UNESCO 1973) **>**

ELEMENT DISTRIBUTION

Global Range: This green ash - American elm - sugarberry community is found throughout the central and southern United States on floodplains of major rivers from Texas, Oklahoma, Arkansas, north to southern Illinois and adjacent Indiana, east to Tennessee, and south to Louisiana. The range formerly included states of the Atlantic Coastal Plain, but now see *Fraxinus pennsylvanica - Ulmus americana / Carpinus caroliniana / Boehmeria cylindrica* Forest (CEGL007806).

Nations: US

States/Provinces: AL:S2, AR, IL, IN, KY, LA, MO, MS, OK, TN, TX?

TNC Ecoregions: 38:C, 39:C, 40:C, 41:C, 42:C, 43:C, 44:C, 50:P, 53:C

USFS Ecoregions (1994/95): 221D:CC, 222Cg:CCC, 222D:CP, 222E:CP, 231Ba:CCP, 231Be:CCC, 231Bi:CCC, 231C:CP, 231D:CP, 231E:CC, 231G:C?, 232Bb:CCC, 232D:CP, 232F:CC, 234Aa:CCC, 234Ac:CCC, 234Ad:CCC, 234Ae:CCP, 234Af:CCC, 234Ag:CCC, 234Ah:CCC, 234Ai:CCC, 234Aj:CCC, 234Ak:CCC, 234Al:CCC, 234Am:CCC, 234An:CCC, M231A:CP

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Federal Lands: DOE (Oak Ridge); NPS (Buffalo River, Natchez Trace, Shiloh, Stones River); USFS (Angelina?, Bienville, Davy Crockett?, Delta, Kisatchie, Sabine?, Sam Houston?, Shawnee, St. Francis); USFWS (Hatchie, Lower Hatchie?, Reelfoot?)

ELEMENT SOURCES

Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: M. Guetersloh, mod. M. Pyne and D. Faber-Langendoen
References: Allard 1990, Collingwood and Brush 1984, Cowardin et al. 1979, Diamond 1993, Eyre 1980, Foti 1994b, Foti et al. 1994, Hoagland 1997, Hoagland 2000, Kuchler 1964, Nelson 1985, Nordman 2004, Penfound 1948, Penfound 1953, Rice and Penfound 1956, Rosson 1995, Schafale 2000, Schafale and Weakley 1990, Smith 1996a, Smith and Craig 1990, Southeastern Ecology Working Group n.d., TDNH unpubl. data, TNC 1985, TNC 1995a, UNESCO 1973, Voigt and Mohlenbrock 1964, Wharton et al. 1982, White and Madany 1978

1.B.3.Nb. Southeastern North American Flooded & Swamp Forest

M031. Southern Floodplain Hardwood Forest

G034. Oak - Sweetgum Floodplain Forest

Floodplain Canebrake

***Arundinaria gigantea ssp. gigantea* Shrubland**
Giant Cane Shrubland
Identifier: CEGL003836

NVC CLASSIFICATION

Division	Southeastern North American Flooded & Swamp Forest (1.B.3.Nb)
Macrogroup	Southern Floodplain Hardwood Forest (M031)
Group	Oak - Sweetgum Floodplain Forest (G034)
Association (Common name)	Floodplain Canebrake

ELEMENT CONCEPT

Global Summary: This association is characterized by dense, often monospecific thickets of the bamboo shrub *Arundinaria gigantea* (giant cane) occupying large areas referred to as canebrakes. The canebrake shrubland type was historically widespread, but is now rare and occupies very little of its former acreage. It was best developed in streamside flats and alluvial floodplains on ridges and terraces where it was protected from prolonged inundation. Historically, this community covered large areas of many floodplains and streamsides in the Coastal Plain from North Carolina to Texas, Mississippi River Alluvial Plain, Interior Highlands, Interior Low Plateau, Southern Blue Ridge and possibly the Central Appalachians of the southeastern United States. Stands occur on alluvial and loess soils and are often associated with bottomland hardwood forest vegetation. This association is successional and is thought to be maintained by periodic fires. It may have originated following abandonment of aboriginal agricultural fields or other natural and anthropogenic disturbances such as blow-downs and catastrophic floods. Historical accounts report cane as abundant along the Wabash and Ohio drainage systems, as well as common along larger rivers (Buffalo, White, Norfork) in the Ozarks and Ouachitas. It was also reported as common along the Red and Mississippi rivers in Louisiana, Coastal Prairie rivers in Texas, and the Black, Washita, Arkansas, Sabine, Pearl, Tombigbee, Yazoo, Savannah, and St. Mary's rivers. Large, extant canebrakes still exist and have been documented from the Ocmulgee Basin, south of Macon, Georgia. In the Central Appalachians various wetlands, including those on alluvial or loess substrates (streamside flats, bottomlands), were dominated by *Arundinaria* (cane), without an overstory, or with widely scattered trees.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This floodplain canebrake was sampled once in the park at Buffalo Point. The site is a flat floodplain terrace of the Buffalo River that experiences temporary flooding during high-water events. Soil is moderately well-drained silt loam. The unvegetated surface is made up entirely of leaf litter (100% cover). Evidence of disturbance includes the presence of exotic plants.
Global Environment: Stands of this association occur on alluvial and loess soils often affiliated with bottomland hardwood forest vegetation. Historically, it was best developed in streamside flats and alluvial floodplains on ridges and terraces where it was protected from prolonged inundation.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: *Arundinaria gigantea* (giant cane) forms a nearly exclusive closed (100% cover) tall-shrub layer (2-5 m tall); additional species with much lower cover include *Cercis canadensis* (eastern redbud), *Cornus drummondii* (roughleaf dogwood), *Diospyros virginiana* (common persimmon), *Fraxinus pennsylvanica* (green ash), *Ulmus alata* (winged elm), and *Ulmus americana* (American elm). The sparse (20%) short-shrub layer (0.5-1 m) has basically the same make up. The sparse (20%) herbaceous layer includes *Amphicarpaea bracteata* (American hogpeanut), *Carex blanda* (eastern woodland sedge), *Carex jamesii* (James' sedge), *Chasmanthium latifolium* (Indian woodoats), *Elephantopus carolinianus* (Carolina elephantsfoot),

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Polemonium reptans (Greek valerian), *Polygonum virginianum* (jumpseed), and *Verbesina virginica* (white crownbeard). Vines include *Campsis radicans* (trumpet creeper), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax bona-nox* (saw greenbrier), and *Vitis vulpina* (frost grape).

Global Vegetation: The vegetation is dominated by *Arundinaria gigantea* (giant cane). Little else is known about its vegetational characteristics. However, information on its historic patterns of distribution provides some clues as to its ecology. General Land Office surveys and other historical accounts indicate that canebrakes were present in southern Illinois, southern Indiana, Kentucky, Missouri, Arkansas, eastern Texas (south to Wharton County), Louisiana, Tennessee, Mississippi, Alabama, Georgia, and South Carolina. Historical accounts refer to both "pure" stands of cane without an overstory of trees (cane shrublands) and areas with variable overstory closure (woodlands or forests) but with a dense understory dominated by cane as "canebrakes." As currently described, this association refers only to the former, cane shrublands. Cane was abundant along the Wabash and Ohio drainage systems (B. McClain pers. comm. 2000). In Missouri, these canebrakes were also thought to be common in the Ozark Highlands, particularly in southward-draining rivers and streams with finer-textured, more developed soils on upper floodplain terraces (T. Nigh pers. comm. 2000). Stands may be found along larger rivers (Buffalo, White, Norfork) in the Arkansas Ozarks in addition to the Ouachitas. In the Central Appalachians various wetlands, including those on alluvial or loess substrates (streamside flats, bottomlands), were dominated by *Arundinaria* (cane), without an overstory, or with widely scattered trees (Central Appalachian Forest Ecoregional Team pers. comm. 1998). Historic accounts describe large expanses (one area was described as 75 miles long by 1-3 miles wide) of an "ocean of cane" in bottomlands of the Coastal Prairie of Texas (Smeins et al. 1992). No extant occurrences of this vegetation are known from this area today.

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Graminoid	*Arundinaria gigantea* (giant cane)

Global

Stratum	Lifeform	Species
Tall shrub/sapling	Bamboo	*Arundinaria gigantea* (giant cane)

CHARACTERISTIC SPECIES

Buffalo National River: *Arundinaria gigantea* (giant cane)
Global: *Arundinaria gigantea* (giant cane)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Exotic/Invasive: *Convolvulus arvensis* (field bindweed, exotic, Medium/Low), *Lespedeza cuneata* (sericea lespedeza, exotic, Medium), *Vicia sativa* (garden vetch, exotic)
Global: Vulnerable: *Vermivora bachmanii* (bachman's warbler, GH); **Other**: *Limnothlypis swainsonii* (swainson's warbler, G4)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2? (15-Feb-1999). Stands of this vegetation type were historically widespread, but now are rare or occupy very little acreage. It is thought to be maintained by frequent fire and may have historically resulted from aboriginal agriculture and burning. Dense, monospecific stands of *Arundinaria gigantea ssp. gigantea* (giant cane) were historically found in bottomland sites throughout the southeastern United States. Today, this vegetation exists as small remnants, and high-quality examples are extremely rare.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: This is a general placeholder, covering a broad geographic range, and several associations may ultimately be recognized. Dense, monospecific stands of *Arundinaria gigantea ssp. gigantea* (giant cane) were historically found in bottomland sites in the southeastern United States. Today, high-quality examples are extremely rare, if not absent. Historical accounts refer to both "pure" stands of cane without an overstory of trees (cane shrublands) and areas with variable overstory closure (woodlands or forests) but with a dense understory dominated by cane as "canebrakes." As currently described, this association refers only to the former, cane shrublands.
Global Related Concepts:
P5A4bIII4a. *Arundinaria gigantea* (Foti et al. 1994) **?**
Piedmont/Mountain Canebrake (Schafale 2002) **=**
Piedmont/Mountain Canebrake (Schafale 1998b) **?**

ELEMENT DISTRIBUTION

Buffalo National River Range: This floodplain canebrake was sampled at Buffalo Point.
Global Range: This association was widespread historically but now occupies very little acreage. It may be found along rivers and streamsides in Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and possibly Virginia (?).

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Nations: US
States/Provinces: AL, AR, FL?, GA, IL, KY, LA, MO, MS, NC, OK, SC, TN, TX, VA?
TNC Ecoregions: 31:P, 32:P, 38:C, 39:C, 40:C, 41:P, 42:C, 43:P, 44:C, 50:C, 51:C, 52:C, 53:P, 56:C, 57:P, 59:C
USFS Ecoregions (1994/95): 221Ha:CC?, 221Hc:CCP, 221Hd:CCP, 221He:CC?, 221Ja:CCC, 221Jb:CCP, 221Jc:CCP, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Ca:CCP, 222Cb:CCP, 222Cc:CCP, 222Cd:CCP, 222Ce:CCP, 222Cf:CCP, 222Cg:CCP, 222Ch:CCP, 222Da:CCP, 222Db:CCP, 222Dc:CCP, 222Dd:CCP, 222De:CCP, 222Dg:CCP, 222Di:CCP, 222Dj:CCP, 222Ea:CCC, 222Eb:CCC, 222Ec:CCC, 222Ed:CCC, 222Ef:CCP, 222Eg:CCP, 222Eh:CCC, 222Ei:CCP, 222Ej:CC?, 222Ek:CCP, 222El:CCP, 222Em:CCP, 222En:CC?, 222Eo:CC?, 222Fa:CCC, 222Fb:CCC, 222Fc:CCC, 222Fd:CCC, 222Ff:CC?, 231Aa:CCP, 231Ab:CCC, 231Ac:CCP, 231Ad:CCP, 231Ae:CCP, 231Af:CCP, 231Ag:CC?, 231Ah:CC?, 231Ai:CCP, 231Am:CC?, 231An:CC?, 231Ao:CCP, 231Ba:CCP, 231Bb:CCP, 231Bc:CCP, 231Bd:CCP, 231Be:CCP, 231Bf:CCP, 231Bg:CCP, 231Bh:CCP, 231Bi:CCP, 231Bj:CCP, 231Bk:CCP, 231Bl:CCP, 231Ca:CCP, 231Cb:CCP, 231Cc:CCP, 231Cd:CCP, 231Ce:CCP, 231Cf:CCP, 231Cg:CCP, 231Da:CCP, 231Db:CCP, 231Dc:CCP, 231Dd:CCP, 231De:CCP, 231Ea:CCP, 231Eb:CCP, 231Ec:CCC, 231Ed:CCC, 231Ee:CCP, 231Ej:CCP, 231Ek:CCP, 231Em:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 234Aa:CCC, 234Ab:CC?, 234Ac:CCP, 234Ad:CCP, 234Ae:CCC, 234Af:CCP, 234Ag:CCC, 234Ah:CC?, 234Ai:CCC, 234Aj:CC?, 234Ak:CC?, 234Al:CCP, 234Am:CCC, 234An:CCC, 255Da:PPP, 255Db:PPP, M221Dc:CCC, M221Dd:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC
Federal Lands: BIA (Eastern Band of Cherokee); NPS (Abe Lincoln Birthplace?, Blue Ridge Parkway?, Buffalo River, Chickamauga-Chattanooga?, Cowpens, Great Smoky Mountains, Horseshoe Bend, Ninety Six, Ozark Riverways?); USFS (Cherokee?, Mark Twain, Ouachita (Coastal Plain)?, Ouachita (Mountains)?, Ouachita?, Ozark, St. Francis); USFWS (Little River, San Bernard?)

ELEMENT SOURCES

Buffalo National River Plots: (1 plot): BUFF.722.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: K.D. Patterson, mod. D. Faber-Langendoen, mod. J. Teague
References: Barden 1997, Blair 1938, CAP pers. comm. 1998, Campbell 1980, Campbell 1989b, Davidson 1950, Flores 1984, Foti et al. 1994, Heineke 1987, Hoagland 1997, Hoagland 1998c, Hoagland 2000, Hughes 1966, McClain pers. comm., McInteer 1952, Meanley 1972, Mohr 1901, Nigh pers. comm., Nuttall 1821, Peet et al. unpubl. data, Platt and Brantley 1992, Platt and Brantley 1997, Schafale 1998b, Schafale 2002, Schafale 2011, Schotz pers. comm., Smeins et al. 1992, Southeastern Ecology Working Group n.d., TDNH unpubl. data, West 1934

Ouachita-Ozark Small Stream Hardwood Forest

***Liquidambar styraciflua - (Quercus alba, Acer saccharum) / Carpinus caroliniana / Lindera benzoin* Forest**
Sweetgum - (White Oak, Sugar Maple) / American Hornbeam / Northern Spicebush Forest
Identifier: CEGL007826

NVC CLASSIFICATION

Division	Southeastern North American Flooded & Swamp Forest (1.B.3.Nb)
Macrogroup	Southern Floodplain Hardwood Forest (M031)
Group	Oak - Sweetgum Floodplain Forest (G034)
Association (Common name)	Ouachita-Ozark Small Stream Hardwood Forest

ELEMENT CONCEPT

Global Summary: This community includes hardwood forests associated with small or intermittent streams in the Ouachita Mountains and Ozarks of Arkansas and Oklahoma. These forests develop on small alluvial flats, terraces, and levees, often on or adjacent to cobble bars. In contrast to forests found on larger rivers (broader floodplains) in the region, vegetation zonation in this community is absent or poorly defined. Examples of this community may have ambiguous hydrology and are often described as being on the conceptual border between upland and temporarily flooded, a fact reflected in the species composition. Canopy composition is variable from site to site but always includes *Liquidambar styraciflua* (sweetgum), often as the main canopy dominant. Other species that may have high coverage in the canopy are *Quercus alba* (white oak), *Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), and *Tilia americana var. caroliniana* (Carolina basswood). Other typical canopy associates are *Betula nigra* (river birch), *Juglans nigra* (black walnut), *Platanus occidentalis* (American sycamore), *Carya cordiformis* (bitternut hickory), *Celtis laevigata* (sugarberry), *Nyssa sylvatica* (blackgum), *Quercus nigra* (water oak), *Quercus rubra* (northern red oak), and *Ulmus americana* (American elm). *Carpinus caroliniana* (American hornbeam) is a typical subcanopy dominant, which can also include *Ostrya virginiana* (hophornbeam), *Magnolia acuminata* (cucumber-tree), *Cercis canadensis* (eastern redbud), and *Acer negundo* (box-elder). The shrub layer varies in density and composition from site to site. Characteristic shrubs are *Lindera benzoin* (northern spicebush), *Arundinaria gigantea* (giant cane), *Alnus serrulata* (hazel alder), *Callicarpa americana* (American beautyberry), *Dirca palustris* (eastern leatherwood), and *Hypericum prolificum* (shrubby St. Johnswort). *Toxicodendron radicans* (eastern poison-ivy) and *Parthenocissus quinquefolia* (Virginia creeper) are common vines. The herbaceous strata can be species-rich on some sites, but other examples have sparse, species-poor herb layers.

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Typical species include *Boehmeria cylindrica* (small-spike false nettle), *Brachyelytrum erectum* (bearded shorthusk), *Carex* (sedge) sp., *Chasmanthium latifolium* (Indian woodoats), *Dioscorea oppositifolia* (Chinese yam), *Iris cristata* (dwarf crested iris), *Pedicularis canadensis* (Canadian lousewort), *Polygonum virginianum* (jumpseed), and *Verbesina alternifolia* (wingstem).

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This small stream sweetgum forest was sampled at 11 locations in the park. Sites include temporarily flooded alluvial terrace and cobble bar, a saturated seep, moderately sloping hillslope bedrock outcrop and channel bed, and somewhat steep, south- and west-facing colluvial lower slopes. As with site topography, soils are variable and include rapidly to moderately well-drained sand, silt loam and sandy loam, to somewhat poorly drained clay loam and loam (seep). The unvegetated surface is made up of leaf litter (15-93% cover), bedrock (0-2%), large rocks (3-50%), small rocks (0-44%), wood (0-10%), standing water (one site with 4% cover), and bare soil (0-76%). Evidence of disturbance includes flooding and hydrologic alterations, roads and trails, past fires, and the presence of exotic plants.

Global Environment: This community includes hardwood forests associated with small or intermittent streams in the Ouachita Mountains and Ozarks of Arkansas and Oklahoma. These forests develop on small alluvial flats, terraces, and levees, often on or adjacent to cobble bars. In contrast to forests found on larger rivers (broader floodplains) in the region, vegetation zonation in this community is absent to poorly defined. Examples of this community may have ambiguous hydrology and are often described as being on the conceptual border between upland and temporarily flooded, a fact reflected in the species composition.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The sparse to dense (10-80% cover) tree canopy, 10-35 m tall, is dominated by *Liquidambar styraciflua* (sweetgum), as is the sparse to moderately dense (20-70%) subcanopy (5-20 m); additional species may include *Acer negundo* (box-elder), *Carya alba* (mockernut hickory), *Carya cordiformis* (bitternut hickory), *Juglans nigra* (black walnut), *Juniperus virginiana* (eastern red-cedar), *Nyssa sylvatica* (blackgum), *Platanus occidentalis* (American sycamore), *Quercus alba* (white oak), *Quercus muehlenbergii* (chinkapin oak), and *Ulmus rubra* (slippery elm). The sparse to moderate (20-50%) tall-shrub layer (2-5 m) and sparse to moderate (10-60%) short-shrub layer (0.5-1 m) may include *Acer rubrum* (red maple), *Aesculus pavia* (red buckeye), *Asimina triloba* (pawpaw), *Carpinus caroliniana* (American hornbeam), *Celtis occidentalis* (common hackberry), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Frangula caroliniana* (Carolina buckthorn), *Fraxinus americana* (white ash), *Fraxinus quadrangulata* (blue ash), *Lindera benzoin* (northern spicebush), *Magnolia acuminata* (cucumber-tree), *Ostrya virginiana* (hophornbeam), *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), *Staphylea trifolia* (American bladdernut), *Symphoricarpos orbiculatus* (coralberry), *Ulmus alata* (winged elm), and *Viburnum rufidulum* (rusty blackhaw). The sparse to very dense (30-90%) herbaceous layer includes *Amphicarpaea bracteata* (American hogpeanut), *Brachyelytrum erectum* (bearded shorthusk), *Chasmanthium latifolium* (Indian woodoats), *Dichanthelium boscii* (Bosc's panicgrass), *Galium circaezans* (licorice bedstraw), *Phegopteris hexagonoptera* (broad beechfern), *Phryma leptostachya* (American lopseed), *Polystichum acrostichoides* (Christmas fern), and *Sanicula canadensis* (Canadian blacksnakeroot). Vines (up to 30%) include *Parthenocissus quinquefolia* (Virginia creeper), *Smilax bona-nox* (saw greenbrier), and *Toxicodendron radicans* (eastern poison-ivy). This community also supports state-imperiled *Carex mesochorea* (midland sedge) and *Arnoglossum muehlenbergii* (great Indian plaintain), and globally and state-vulnerable *Amorpha ouachitensis* (Ouachita false indigo), *Delphinium newtonianum* (Newton's larkspur), and *Tradescantia ozarkana* (Ozark spiderwort).

Global Vegetation: Canopy composition in stands of this association is variable from site to site, but always includes *Liquidambar styraciflua* (sweetgum), often as the main canopy dominant. Other species that may have high coverage in the canopy are *Quercus alba* (white oak), *Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), and *Tilia americana var. caroliniana* (Carolina basswood). Other typical canopy associates are *Betula nigra* (river birch), *Juglans nigra* (black walnut), *Platanus occidentalis* (American sycamore), *Carya cordiformis* (bitternut hickory), *Celtis laevigata* (sugarberry), *Nyssa sylvatica* (blackgum), *Quercus nigra* (water oak), *Quercus rubra* (northern red oak), and *Ulmus americana* (American elm). *Carpinus caroliniana* (American hornbeam) is a typical subcanopy dominant. The subcanopy can also include species from the canopy, as well as *Ostrya virginiana* (hophornbeam), *Magnolia acuminata* (cucumber-tree), *Cercis canadensis* (eastern redbud), and *Acer negundo* (box-elder). The shrub layer varies in density and composition from site to site. Characteristic shrubs are *Lindera benzoin* (northern spicebush), *Arundinaria gigantea* (giant cane), *Alnus serrulata* (hazel alder), *Callicarpa americana* (American beautyberry), *Dirca palustris* (eastern leatherwood), and *Hypericum prolificum* (shrubby St. Johnswort). *Toxicodendron radicans* (eastern poison-ivy) and *Parthenocissus quinquefolia* (Virginia creeper) are common vines. The herbaceous strata can be species-rich on some sites, but other examples have sparse, species-poor herb layers. Typical species include *Boehmeria cylindrica* (small-spike false nettle), *Brachyelytrum erectum* (bearded shorthusk), *Carex* (sedge) sp., *Chasmanthium latifolium* (Indian woodoats), *Dioscorea oppositifolia* (Chinese yam), *Iris cristata* (dwarf crested iris), *Pedicularis canadensis* (Canadian lousewort), *Polygonum virginianum* (jumpseed), and *Verbesina alternifolia* (wingstem), although many other species can be present.

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Liquidambar styraciflua* (sweetgum), *Platanus occidentalis* (American sycamore)

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Tall shrub/sapling	Broad-leaved deciduous shrub	*Carpinus caroliniana* (American hornbeam), *Cornus florida* (flowering dogwood)
Herb (field)	Forb	*Amphicarpaea bracteata* (American hogpeanut), *Galium circaezans* (licorice bedstraw), *Toxicodendron radicans* (eastern poison-ivy)

CHARACTERISTIC SPECIES

Buffalo National River: *Amphicarpaea bracteata* (American hogpeanut), *Carpinus caroliniana* (American hornbeam), *Cornus florida* (flowering dogwood), *Galium circaezans* (licorice bedstraw), *Liquidambar styraciflua* (sweetgum), *Platanus occidentalis* (American sycamore), *Toxicodendron radicans* (eastern poison-ivy)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Amorpha ouachitensis* (Ouachita false indigo, globally and state-vulnerable, G3Q), *Arnoglossum muehlenbergii* (great Indian plaintain, state-imperiled, G4), *Carex mesochorea* (midland sedge, state-imperiled, G4G5), *Delphinium newtonianum* (Newton's larkspur, globally and state-vulnerable, G3), *Euonymus obovatus* (running strawberry bush, state-vulnerable, G5), *Tradescantia ozarkana* (Ozark spiderwort, globally and state-vulnerable, G3); **Exotic/Invasive**: *Albizia julibrissin* (silktree, exotic, High/Low), *Dioscorea oppositifolia* (Chinese yam, exotic, High/Medium), *Lonicera japonica* (Japanese honeysuckle, exotic, High/Medium), *Medicago minima* (little bur-clover, exotic), *Microstegium vimineum* (Nepalese browntop, exotic, High/Medium), *Perilla frutescens* (beefsteakplant, exotic, Low), *Poa pratensis* (Kentucky bluegrass, exotic, Medium), *Polygonum convolvulus* (black bindweed, exotic), *Rosa multiflora* (multiflora rose, exotic, Medium/Low), *Saponaria officinalis* (bouncingbet, exotic, Low/Insignificant), *Stellaria media* (common chickweed, exotic, Low), *Trifolium pratense* (red clover, exotic, Low/Insignificant)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (5-Jan-2001). This bottomland forest is found in the Ouachita Mountains and Ozarks of Arkansas and Oklahoma. It is not an inherently rare forest type, but at least moderately widespread, and is presumed to be relatively common throughout its range. It is not restricted to any highly specific geologic substrates. It is poorly documented through EOs, and not much data are available on the specific condition of examples of this type. Some examples are present on the Ouachita and Ozark national forests, and these could be conserved there. Some stands have been impacted by removal of more valuable timber species (e.g., *Quercus alba* (white oak)) and loss of herbaceous species diversity from the disturbance effects of logging. In all probability, most examples which are not on public land have been repeatedly logged and their composition altered thereby. Remaining unprotected examples are threatened by timber removal, conversion to other managed forest types, and/or development into residential or commercial real estate.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: Examples of *Fagus grandifolia - Quercus rubra - Tilia americana var. caroliniana / Magnolia tripetala / Podophyllum peltatum* Forest (CEGL007823) that occur in and along streams may be similar to this community. Similar associations are also found in *Fagus grandifolia* (American beech) Temporarily Flooded Forest Alliance (A.284).
Global Similar Associations:
Acer (saccharum, barbatum) - Quercus rubra - Carya cordiformis / Asimina triloba Forest (CEGL002060)
Fagus grandifolia - Quercus rubra - Tilia americana var. caroliniana / Magnolia tripetala / Podophyllum peltatum Forest (CEGL007823)

ELEMENT DISTRIBUTION

Buffalo National River Range: This small stream sweetgum forest was sampled along Boxley Trail, Indian Rockhouse Trail (Panther Creek), near Collier Homestead Historic Site, Turkey Mountain, Buffalo Point, Richland Valley and Tyler Bend.
Global Range: This forest is found in the Ouachita Mountains and Ozarks of Arkansas and Oklahoma.
Nations: US
States/Provinces: AR, OK
TNC Ecoregions: 38:C, 39:C
USFS Ecoregions (1994/95): 222Ag:CCC, 222An:CCC, 231G:CC, M222Aa:CCC, M231A:CC
Federal Lands: NPS (Buffalo River); USFS (Ouachita, Ouachita (Mountains), Ozark)

ELEMENT SOURCES

Buffalo National River Plots: (11 plots): BUFF.027, BUFF.028, BUFF.029, BUFF.097, BUFF.098, BUFF.099, BUFF.152, BUFF.162, BUFF.723, BUFF.732, BUFF.743.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: K.D. Patterson, M. Pyne, S. Landaal
References: Foti 1994b, NatureServe Ecology - Southeastern U.S. unpubl. data, Southeastern Ecology Working Group n.d.

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Bur Oak - Shumard Oak Mixed Bottomland Forest

***Quercus macrocarpa - Quercus shumardii - Carya cordiformis / Chasmanthium latifolium* Forest**
Bur Oak - Shumard Oak - Bitternut Hickory / River-oats Forest
Identifier: CEGL004544

NVC CLASSIFICATION

Division	Southeastern North American Flooded & Swamp Forest (1.B.3.Nb)
Macrogroup	Southern Floodplain Hardwood Forest (M031)
Group	Oak - Sweetgum Floodplain Forest (G034)
Association (Common name)	Bur Oak - Shumard Oak Mixed Bottomland Forest

ELEMENT CONCEPT

Global Summary: This association is found in the United States in the southeastern Great Plains and adjacent Ozark-Ouachita region, ranging from the Arbuckle Mountains of Oklahoma to northeastern Oklahoma and southeastern Kansas and adjacent Missouri and Arkansas. Stands occur on floodplains, where they are temporarily flooded for short periods as a result of river flooding, and more rarely on other mesic habitats. Soils are deep, medium-textured and formed in alluvium. The vegetation is dominated by a closed-canopy layer of trees, with *Quercus macrocarpa* (bur oak), *Quercus shumardii* (Shumard oak), and *Carya cordiformis* (bitternut hickory) the major dominants. Other characteristic species include *Carya illinoinensis* (pecan), *Frangula caroliniana* (Carolina buckthorn), *Populus deltoides* (eastern cottonwood), and *Ulmus americana* (American elm) in Oklahoma and *Acer negundo* (box-elder), *Acer saccharinum* (silver maple), *Fraxinus pennsylvanica* (green ash), and *Platanus occidentalis* (American sycamore) in Kansas. Ground layer species include *Carex* (sedge) spp. and *Leersia oryzoides* (rice cutgrass).

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This bur oak mixed bottomland forest was sampled twice in the park. One site is a somewhat steep, north-facing low terrace above a cobble bar of the Buffalo River. It is semipermanently flooded with moderately well-drained loam soil. The other is a gently sloping streambank and terrace with poorly drained clay soil. The unvegetated surface is made up of leaf litter (35-99% cover) with some wood (1-5%) and bare soil (0-65%). Evidence of disturbance includes the presence of trails and exotic plants.

Global Environment: Stands occur on floodplains, where they are temporarily flooded for short periods as a result of river flooding, and more rarely on other mesic habitats (Hoagland 1997). Soils are deep, medium-textured and formed in alluvium (Lauver et al. 1999).

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The sparse to dense (20-80% cover) tree canopy, 15-35 m tall, is dominated by *Quercus macrocarpa* (bur oak) with or without *Ulmus americana* (American elm), as is the moderate (50%) subcanopy (10-15 m) found at one site. The sparse (20-40%) tall-shrub layer (2-5 m) and sparse to moderate (20-60%) short-shrub layer (0.5-1 m) may include *Acer negundo* (box-elder), *Arundinaria gigantea* (giant cane), *Asimina triloba* (pawpaw), *Celtis occidentalis* (common hackberry), *Morus rubra* (red mulberry), *Prunus serotina* (black cherry), and *Staphylea trifolia* (American bladdernut), among others. The Common taxa in the herbaceous layer (50-70%) include *Laportea canadensis* (Canadian woodnettle), *Ageratina altissima* (white snakeroot), *Elymus virginicus* (Virginia wildrye), *Parthenocissus quinquefolia* (Virginia creeper), *Polygonum virginianum* (jumpseed), and *Rudbeckia laciniata* (cutleaf coneflower).

Global Vegetation: The vegetation is dominated by a closed-canopy layer of trees, with *Quercus macrocarpa* (bur oak), *Quercus shumardii* (Shumard oak), and *Carya cordiformis* (bitternut hickory) the major dominants. Other characteristic species include *Carya illinoinensis* (pecan), *Frangula caroliniana* (Carolina buckthorn), *Populus deltoides* (eastern cottonwood), and *Ulmus americana* (American elm) in Oklahoma (Hoagland 1997) and *Acer negundo* (box-elder), *Acer saccharinum* (silver maple), *Fraxinus pennsylvanica* (green ash), and *Platanus occidentalis* (American sycamore) in Kansas (Lauver et al. 1999). Ground layer species include *Carex* (sedge) spp. and *Leersia oryzoides* (rice cutgrass).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Quercus macrocarpa* (bur oak), *Ulmus americana* (American elm)
Short shrub/sapling	Broad-leaved deciduous shrub	*Staphylea trifolia* (American bladdernut)
Herb (field)	Forb	*Laportea canadensis* (Canadian woodnettle)

CHARACTERISTIC SPECIES

Buffalo National River: *Arundinaria gigantea* (giant cane), *Celtis occidentalis* (common hackberry), *Laportea canadensis* (Canadian woodnettle), *Quercus macrocarpa* (bur oak), *Staphylea trifolia* (American bladdernut)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Exotic/Invasive: *Alliaria petiolata* (garlic mustard, exotic, High/Medium), *Glechoma hederacea* (ground ivy, exotic, Low), *Kummerowia striata* (Japanese clover, exotic, Low), *Lespedeza cuneata* (sericea lespedeza, exotic, Medium), *Lonicera japonica* (Japanese honeysuckle, exotic, High/Medium), *Rosa multiflora* (multiflora rose, exotic, Medium/Low)

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CONSERVATION STATUS RANK

Global Rank & Reasons: G3? (22-Oct-2009). This type is ranked S1S2 in Kansas, S? in Oklahoma, and it may occur in Missouri. The type has a very restricted distribution and few high-quality occurrences have been reported. Some examples are protected in the Buffalo National River (Arkansas).

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak

ELEMENT DISTRIBUTION

Buffalo National River Range: This bur oak mixed bottomland forest was sampled just upstream of the main canoe launch ramp at Tyler Bend and at Mt. Hersey.
Global Range: This association is found in the United States in the southeastern Great Plains and possibly adjacent Ozark-Ouachita region, ranging from northeastern Oklahoma and the Arbuckle Mountains of Oklahoma to southeastern Kansas and adjacent Missouri and Arkansas.
Nations: US
States/Provinces: AR, KS:S1S2, MO, OK
TNC Ecoregions: 32:C, 37:C, 38:C, 39:?
USFS Ecoregions (1994/95): 222An:CCC, 255Af:CCC, M231Ab:???
Federal Lands: NPS (Buffalo River, Chickasaw NRA)

ELEMENT SOURCES

Buffalo National River Plots: (2 plots): BUFF.119, BUFF.758.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: B. Hoagland, mod. C. Lauver and D. Faber-Langendoen
References: Blair 1938, Featherly 1940, Hefley 1937, Hoagland 1997, Hoagland 2000, Lauver et al. 1999, Southeastern Ecology Working Group n.d.

2. SHRUBLAND & GRASSLAND

2.B.2. Temperate Grassland, Meadow & Shrubland

2.B.2.Nc. Eastern North American Grassland, Meadow & Shrubland

M124. Northern & Central Alvar & Glade

G178. Northern & Central Acidic Glade

Ozark Basic Sandstone Glade

***Quercus stellata* - (*Pinus echinata*) / *Vaccinium arboreum* / *Andropogon gerardii* - *Symphyotrichum patens* *var. patentissimum* Wooded Herbaceous Vegetation**
Post Oak - (Shortleaf Pine) / Farkleberry / Big Bluestem - Western Clasping Aster Wooded Herbaceous Vegetation
Identifier: CEGL007814

NVC CLASSIFICATION

Division	Eastern North American Grassland, Meadow & Shrubland (2.B.2.Nc)
Macrogroup	Northern & Central Alvar & Glade (M124)
Group	Northern & Central Acidic Glade (G178)
Association (Common name)	Ozark Basic Sandstone Glade

ELEMENT CONCEPT

Global Summary: This Ozarkian glade community is described from a sandstone substrate, but the flora appears to have some affinities with somewhat basic sites. It occurs as narrow bands on a sloping landform, with sandstone outcrops and rubble at the surface. The local expression may vary from woodland to herbaceous, but it is placed here. A generally sparse (to 30%) cover of trees is dominated by *Quercus stellata* (post oak), *Pinus echinata* (shortleaf pine), and *Ulmus alata* (winged elm). *Juniperus virginiana* (eastern red-cedar) may be found in various strata. Some *Celtis tenuifolia* (dwarf hackberry), *Prunus mexicana* (Mexican plum), *Rhus copallinum* (winged sumac), and *Vaccinium arboreum* (farkleberry) are present in an open to sparse tall-shrub stratum. Vines include *Smilax bona-nox* (saw greenbrier) and *Passiflora lutea* (yellow passionflower). Perennial grasses include *Andropogon gerardii* (big bluestem), *Schizachyrium scoparium* (little bluestem), *Danthonia spicata* (poverty oatgrass), and *Dichanthelium linearifolium* (slimleaf panicgrass). Forbs include *Symphyotrichum oblongifolium* (aromatic aster), *Baptisia bracteata var. leucophaea* (longbract

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wild indigo), *Croton capitatus* (hogwort), *Cunila origanoides* (common dittany), *Echinacea pallida* (pale purple coneflower), *Helianthus hirsutus* (hairy sunflower), *Hypericum drummondii* (nits and lice), *Liatris aspera* (tall blazing star), *Liatris squarrosa* (scaly blazing star), *Mimosa nuttallii* (Nuttall's sensitive-briar), *Nemastylis nuttallii* (Nuttall's pleatleaf), *Opuntia humifusa var. humifusa* (devil's-tongue), *Parthenium integrifolium* (wild quinine), *Polytaenia nuttallii* (Nuttall's prairie parsley), *Ruellia strepens* (limestone wild petunia), *Silphium laciniatum* (compassplant), *Solidago petiolaris* (downy ragged goldenrod), *Solidago ulmifolia* (elmleaf goldenrod), and *Vernonia missurica* (Missouri ironweed). *Symphyotrichum patens var. patentissimum* (late purple aster) is included as a nominal to indicate a relatively western (e.g., Ozark) distribution. The presence of abundant *Andropogon gerardii* (big bluestem) and some more basophilic elements distinguishes this from other sandstone glades, including those of the Ouachitas.

CONSERVATION STATUS RANK

Global Rank & Reasons: G2? (11-Dec-1998). A limited amount of information is presently available about this basic sandstone glade community. Its flora would indicate that it is probably restricted to a particular geologic substrate and set of environmental conditions, and it is probably restricted to U.S. Forest Service lands. It is most likely threatened by grazing or lack of fire management than by conversion to commercial forestry practices. More information is needed on the processes and dynamics of this association.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: Described from the Bayou Ranger District of the Ozark National Forest. More information is needed about the global range of this community, as well as the substrate(s) on which it is found.

ELEMENT DISTRIBUTION

Global Range: This community is found in the Ozark Mountains of northern Arkansas.
Nations: US
States/Provinces: AR
TNC Ecoregions: 38:C
USFS Ecoregions (1994/95): 222Ag:CCC, M222Aa:CCP, M222Ab:CCC
Federal Lands: NPS (Buffalo River); USFS (Ozark)

ELEMENT SOURCES

Buffalo National River Plots: (10 plots): BUFF.106, BUFF.112, BUFF.113, BUFF.115, BUFF.176, BUFF.223, BUFF.712, BUFF.718, BUFF.818, BUFF.918.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: M. Pyne and A.S. Weakley
References: NatureServe Ecology - Southeastern U.S. unpubl. data, Southeastern Ecology Working Group n.d.

Ozark Sandstone Glade

***Schizachyrium scoparium - Aristida dichotoma - Croton willdenowii* / Lichens Wooded Herbaceous Vegetation**
Little Bluestem - Forktip Three-awn - Willdenow's Croton / Lichens Wooded Herbaceous Vegetation
Identifier: CEGL002242

NVC CLASSIFICATION

Division	Eastern North American Grassland, Meadow & Shrubland (2.B.2.Nc)
Macrogroup	Northern & Central Alvar & Glade (M124)
Group	Northern & Central Acidic Glade (G178)
Association (Common name)	Ozark Sandstone Glade

ELEMENT CONCEPT

Global Summary: This sandstone glade community is found in the Ozark region of the south-central United States. Stands occur as outcrops along narrow ridges, on bluff escarpments, on rolling upland exposures, or on broad conical knobs. Parent material is sandstone, and aspect is somewhat neutral, with best development of the type occurring on south- and west-facing slopes. Soils are very shallow (0-40 cm), with occasional vernal pools. The vegetation is dominated by mid grasses and forbs; mosses and lichens are very abundant on areas of exposed rock. Scattered stunted xerophytic trees and shrubs are also present, in particular *Quercus stellata* (post oak), *Quercus marilandica* (blackjack oak), *Pinus echinata* (shortleaf pine), *Juniperus virginiana* (eastern red-cedar), and *Vaccinium arboreum* (farkleberry). Common herbaceous plants include *Aristida dichotoma* (churchmouse threeawn), *Coreopsis grandiflora* (largeflower tickseed) (in Arkansas), *Croton willdenowii* (Willdenow's croton), and *Schizachyrium scoparium* (little bluestem). Other characteristic herbs include *Asclepias hirtella* (green milkweed), *Chaetopappa asteroides* (Arkansas leastdaisy), *Croton capitatus* (hogwort), *Diodia teres* (poorjoe), *Eragrostis spectabilis* (purple lovegrass), *Isoetes butleri* (limestone quillwort), *Lechea mucronata* (hairy pinweed), *Plantago pusilla* (dwarf plantain), *Hypericum gentianoides* (orangegrass), *Hypericum drummondii* (nits and lice), *Saxifraga texana* (Texas saxifrage), *Sedum pulchellum* (widowscross), *Sedum nuttallianum* (yellow stonecrop), *Talinum calycinum* (largeflower fameflower), and *Talinum parviflorum* (sunbright).

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ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This open glade community was sampled once in the park. The site is a moderate, north--facing hillslope bedrock outcrops. Soil is rapidly drained sand. The unvegetated surface is made up of exposed bedrock (70% cover), leaf litter (28%), and wood (2%). Evidence of disturbance includes past fire and the presence of exotic plants.
Global Environment: Stands occur as outcrops along narrow ridges, on bluff escarpments, on rolling upland exposures, or on broad conical knobs. The aspect is somewhat neutral, with best development of the type occurring on south- and west-facing slopes. Soils are very shallow (0-40 cm), with occasional vernal pools. Stands occur on a variety of Pennsylvanian sandstone formations, including the St. Peter, Lamotte, Gasconade, Channel Sands, Roubidoux, and Gunter (Nelson and Ladd 1983, Jeffries 1985, Nelson 1985). Even thought these sites are generally thought of as acidic, at one Arkansas example cited by Jeffries (1985) soil pH varied from 4.7 to 8.8, perhaps due to influences from adjoining forests.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: The very sparse (5%) tall-shrub layer (2-5 m) is dominated by *Juniperus virginiana* (eastern red-cedar). The very sparse (50%) short-shrub layer (0.5-1 m) includes *Rubus flagellaris* (northern dewberry) and *Vaccinium arboreum* (farkleberry). The herbaceous layer, though sparse (30%), is fairly diverse with over 35 species recorded. Dominant species include *Astranthium integrifolium ssp. ciliatum* (entireleaf western daisy), *Clinopodium arkansanum* (limestone calamint), *Croton willdenowii* (Willdenow's croton), *Oenothera linifolia* (threadleaf evening-primrose), and *Selenia aurea* (golden selenia). Mosses and lichens, including *Cladina* (reindeer lichen) spp., may have up to 30% cover.
Global Vegetation: The vegetation is dominated by mid grasses and forbs; mosses and lichens are very abundant on areas of exposed rock. Scattered stunted xerophytic trees and shrubs are also present, in particular *Quercus stellata* (post oak), *Quercus marilandica* (blackjack oak), *Pinus echinata* (shortleaf pine), *Juniperus virginiana* (eastern red-cedar), and *Vaccinium arboreum* (farkleberry). Common herbaceous plants include *Aristida dichotoma* (churchmouse threeawn), *Coreopsis grandiflora* (largeflower tickseed) (in Arkansas), *Croton willdenowii* (Willdenow's croton), and *Schizachyrium scoparium* (little bluestem). Other characteristic herbs include *Asclepias hirtella* (green milkweed), *Chaetopappa asteroides* (Arkansas leastdaisy), *Croton capitatus* (hogwort), *Diodia teres* (poorjoe), *Eragrostis spectabilis* (purple lovegrass), *Isoetes butleri* (limestone quillwort), *Lechea mucronata* (hairy pinweed), *Plantago pusilla* (dwarf plantain), *Hypericum gentianoides* (orangegrass), *Hypericum drummondii* (nits and lice), *Saxifraga texana* (Texas saxifrage), *Sedum pulchellum* (widowscross), *Sedum nuttallianum* (yellow stonecrop), *Talinum calycinum* (largeflower fameflower), and *Talinum parviflorum* (sunbright) (Nelson and Ladd 1983, Jeffries 1985, Nelson 1985).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Needle-leaved shrub	*Juniperus virginiana* (eastern red-cedar)

CHARACTERISTIC SPECIES

Buffalo National River: *Croton willdenowii* (Willdenow's croton), *Juniperus virginiana* (eastern red-cedar), *Schizachyrium scoparium* (little bluestem)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Exotic/Invasive: *Arenaria serpyllifolia* (thymeleaf sandwort, exotic), *Trifolium campestre* (field clover, exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3 (24-Oct-2002). This sandstone glade community has a fairly limited distribution, being found in the Ozark region of the south-central United States. Stands occupy relatively specific habitats, occurring as sandstone outcrops along narrow ridges, or on bluff escarpments, rolling upland exposures, and broad conical knobs. Over 40 occurrences and 400 acres of this type have already been described from the Missouri portion of its range. Over half are A- or B-ranked, and at least 5 of these are in state natural areas or other protected status. Further work is needed to assess the status of the type in Arkansas. Many of the vascular plants are fairly resilient, widespread species. Less is known about the sensitivity of the nonvascular component.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: Concept of the type is taken from Missouri and Kansas state classifications - sandstone glade (Nelson 1985, Lauver et al. 1999). Type may be in Oklahoma, but needs further review. This sandstone glade community is uncommon, but several high-quality sites remain. The estimated extent in Missouri (Nelson and Ladd 1983) was 810 hectares. This community is affected by extreme drought and infrequent fires. This association is related to, but distinct from, southeastern sandstone glade or outcrop communities east of the Mississippi River. There may be an Ozark Channel Sands subtype characterized by *Schizachyrium scoparium* (little bluestem), *Selenia aurea* (golden selenia), and *Geocarpon minimum* (tinytim). *Croton willdenowii* (Willdenow's croton) has also been known as *Crotonopsis elliptica*.
Global Related Concepts:
Sandstone Glade (Nelson 1985) =
Sandstone Glade (Nelson and Ladd 1983) **?**

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ELEMENT DISTRIBUTION

Buffalo National River Range: This open glade community was sampled west of Cedar Grove along Erbie Campground Road.
Global Range: This sandstone glade community is found in the Ozark region of the south-central United States, particularly Arkansas, Kansas, Missouri and possibly Oklahoma.
Nations: US
States/Provinces: AR, KS:S2?, MO:S2, OK?
TNC Ecoregions: 36:C, 37:C, 38:C, 39:?
USFS Ecoregions (1994/95): 222Aa:CCC, 222Ab:CCC, 222Ac:CCC, 222Ad:CCC, 222Ae:CCC, 222Ag:CCC, 222Aj:CCC, 222Ak:CCC, 222Am:CCC, 251Ce:CCC, 251Eb:CCC, M222Aa:CCC
Federal Lands: NPS (Buffalo River); USFS (Mark Twain, Ouachita (Mountains)?, Ouachita?, Ozark)

ELEMENT SOURCES

Buffalo National River Plots: (1 plot): BUFF.213.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: P. Nelson, mod. D. Faber-Langendoen
References: Foti 1994b, Jeffries 1985, Jeffries 1987, Lauver et al. 1999, Midwestern Ecology Working Group n.d., Nelson 1985, Nelson and Ladd 1983

G179. Northern & Central Alkaline Glade

Ozark Limestone Glade

***Schizachyrium scoparium - Bouteloua curtipendula - Rudbeckia missouriensis - Mentzelia oligosperma* Wooded Herbaceous Vegetation**
Little Bluestem - Sideoats Grama - Missouri Orange Coneflower - Plains Mentzelia Wooded Herbaceous Vegetation
Identifier: CEGL002251

NVC CLASSIFICATION

Division	Eastern North American Grassland, Meadow & Shrubland (2.B.2.Nc)
Macrogroup	Northern & Central Alvar & Glade (M124)
Group	Northern & Central Alkaline Glade (G179)
Association (Common name)	Ozark Limestone Glade

ELEMENT CONCEPT

Global Summary: This bluestem graminoid limestone glade community is found in the Ozarks region of the south-central United States, primarily and characteristically on the Springfield Plateau of Arkansas and Missouri, and in adjacent Kansas. Stands occur on moderate to steep slopes of dissected hills, steep valley slopes above large rivers and streams. Aspect is typically southern and western. Soils are very rapidly drained (seasonally saturated in winter and spring) and shallow (0-40 cm). The parent material is limestone bedrock. The vegetation is dominated by medium-tall grasses and forbs, occasionally with stunted trees and shrubs. Stands are dominated by the grasses *Schizachyrium scoparium* (little bluestem) and *Bouteloua curtipendula* (sideoats grama). Typical forbs and ferns include *Rudbeckia missouriensis* (Missouri orange coneflower), *Draba reptans* (Carolina draba), *Draba cuneifolia* (wedgeleaf draba), *Heliotropium tenellum* (pasture heliotrope), *Isoetes butleri* (limestone quillwort), *Ophioglossum engelmannii* (limestone adderstongue), *Psoralidium tenuiflorum* (slimflower scurfpea), *Sedum pulchellum* (widowscross), *Glandularia canadensis* (rose mock vervain), *Agalinis aspera* (tall false foxglove), *Mentzelia oligosperma* (chickenthief), *Physalis pumila* (dwarf groundcherry), *Chamaesyce missurica* (prairie sandmat), *Astragalus distortus* (Ozark milkvetch), *Erysimum capitatum* (sanddune wallflower), *Castilleja purpurea* (downy Indian paintbrush), *Lesquerella filiformis* (limestoneglade bladderpod) (endemic to the Ozarks), *Talinum parviflorum* (sunbright), *Thelesperma filifolium var. filifolium* (stiff greenthread), *Nothocalais cuspidata* (prairie false dandelion), and lichens, *Lecanora muralis* (rim lichen), *Placidium lachneum*, and *Psora russellii* (Russell's fishscale lichen).

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This little bluestem limestone glade community was sampled twice in the park. Sites are steep to somewhat steep, south-facing ridges; one site is described as a scree blufftop over a river bend. Soils are xeric, rapidly drained clay loam. The unvegetated surface is made up of leaf litter (10-70% cover), exposed bedrock (7-15%), large rocks (2-6%), small rocks (11-68%), and bare soil (1-10%). Evidence of disturbance includes past fire and the presence exotic plant species.
Global Environment: Stands occur on moderate to steep slopes of dissected hills, steep valley slopes above large rivers and streams. Aspect is typically south and west. Soils are very rapidly drained (seasonally saturated in winter and spring) and shallow (0-40 cm). Texture may be clayey. The parent material is limestone bedrock (Burlington, Keokuk, Plattin-Kimmswick formations) interspersed with abundant rock fragments and often dissected by horizontal layers of exposed limestone bedrock (Nelson 1985). These strata may be of Ordovician, Mississippian, or Pennsylvanian age.

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VEGETATION DESCRIPTION

Buffalo National River Vegetation: This community is defined by its moderate (50% cover) herbaceous layer. However, there may be a sparse (30% cover) tree canopy (10-15 m tall) of *Quercus stellata* (post oak), as well as a sparse (20%) tall-shrub (2-5 m) and very sparse (10%) short-shrub layer (0.5-1 m) that may include *Carya texana* (black hickory), *Celtis tenuifolia* (dwarf hackberry), *Juniperus virginiana* (eastern red-cedar), *Quercus stellata* (post oak), *Rhus aromatica* (fragrant sumac), *Sideroxylon lanuginosum* (gum bully), *Ulmus alata* (winged elm), and *Vaccinium arboreum* (farkleberry). Dominants in the herbaceous layer include *Andropogon gerardii* (big bluestem), *Dichanthelium linearifolium* (slimleaf panicgrass), *Eupatorium altissimum* (tall thoroughwort), *Hedyotis nigricans* (diamondflowers), *Melica mutica* (twoflower melicgrass), *Schizachyrium scoparium* (little bluestem), *Silphium laciniatum* (compassplant), *Solidago buckleyi* (Buckley's goldenrod), and *Sphenopholis obtusata* (prairie wedgescale). In addition, this community supports state-imperiled *Scutellaria parvula var. missouriensis* (Leonard's skullcap) and state-vulnerable *Penstemon cobaea* (cobaea beardtongue).

Global Vegetation: The vegetation is dominated by medium-tall grasses and forbs, occasionally with stunted trees and shrubs. Stands are dominated by the grasses *Schizachyrium scoparium* (little bluestem) and *Bouteloua curtipendula* (sideoats grama). Typical forbs and ferns include *Rudbeckia missouriensis* (Missouri orange coneflower) (typically absent in Kansas stands), *Draba reptans* (Carolina draba), *Draba cuneifolia* (wedgeleaf draba), *Heliotropium tenellum* (pasture heliotrope), *Isoetes butleri* (limestone quillwort), *Ophioglossum engelmannii* (limestone adderstongue), *Psoralidium tenuiflorum* (slimflower scurfpea), *Sedum pulchellum* (widowscross), *Glandularia canadensis* (rose mock vervain), *Agalinis aspera* (tall false foxglove), *Mentzelia oligosperma* (chickenthief), *Physalis pumila* (dwarf groundcherry), *Chamaesyce missurica* (prairie sandmat), *Astragalus distortus* (Ozark milkvetch), *Erysimum capitatum* (sanddune wallflower), *Castilleja purpurea* (downy Indian paintbrush), *Lesquerella filiformis* (limestoneglade bladderpod) (endemic to the Ozarks), *Talinum parviflorum* (sunbright), *Thelesperma filifolium var. filifolium* (stiff greenthread), *Nothocalais cuspidata* (prairie false dandelion), and lichens *Lecanora muralis* (rim lichen), *Placidium lachneum*, and *Psora russellii* (Russell's fishscale lichen) (Nelson 1985, Lauver et al. 1999). Other species (Nelson 2005) include, in deeper soil, *Fimbristylis puberula* (hairy fimbry), *Carex meadii* (Mead's sedge), *Hedyotis nigricans* (diamondflowers), *Allium canadense (var. lavandulare)*, *Silphium terebinthinaceum* (prairie rosinweed), *Symphyotrichum sericeum* (western silver aster), and *Delphinium carolinianum* (Carolina larkspur), and on shallow soils, *Croton monanthogynus* (prairie tea), *Croton willdenowii* (Willdenow's croton), *Eleocharis compressa* (flatstem spikerush), *Sporobolus vaginiflorus* (poverty dropseed), *Clinopodium arkansanum* (limestone calamint), and *Nostoc* sp.

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Herb (field)	Forb	*Eupatorium altissimum* (tall thoroughwort)
Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem), *Dichanthelium linearifolium* (slimleaf panicgrass), *Schizachyrium scoparium* (little bluestem)

CHARACTERISTIC SPECIES

Buffalo National River: *Andropogon gerardii* (big bluestem), *Dichanthelium linearifolium* (slimleaf panicgrass), *Eupatorium altissimum* (tall thoroughwort), *Hedyotis nigricans* (diamondflowers), *Schizachyrium scoparium* (little bluestem)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Penstemon cobaea* (cobaea beardtongue, state-vulnerable, G4), *Scutellaria parvula* var. *missouriensis* (Leonard's skullcap, state-imperiled, G4T4); **Exotic/Invasive**: *Bromus japonicus* (Japanese brome, exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2 (22-Jun-1998). There are probably fewer than 60 occurrences rangewide; currently 20 occurrences are documented from Missouri, where it is ranked S2. This community is also reported from Kansas, where it is ranked S1S2?; it may also occur in Arkansas. There are probably fewer than 400 acres rangewide; currently there are about 130 acres documented, and most are less than 10 acres each. Although historical acreage and trends are unknown, this was probably always a small and uncommon community restricted to limestone outcrops in the Ozarks. This community is reported from 11 subsections of two provinces in southern Missouri, eastern Kansas, and possibly northern Arkansas. More than half the currently documented occurrences are in good condition.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Global Comments: Comparison of this association with other limestone glades in the Southeast needs to be completed. One plot in the Buffalo National River (Arkansas) contains *Quercus stellata* (post oak), *Quercus muehlenbergii* (chinkapin oak), *Cercis canadensis* (eastern redbud), *Carya texana* (black hickory), *Cotinus obovatus* (American smoketree), *Liatris squarrosa var. hirsuta* (scaly blazing star), *Dichanthelium linearifolium* (slimleaf panicgrass), *Juniperus virginiana* (eastern red-cedar), *Ulmus alata* (winged elm), *Hedyotis nigricans* (diamondflowers), *Monarda bradburiana* (eastern beebalm), *Lithospermum canescens* (hoary puccoon), *Galium arkansanum* (Arkansas bedstraw), *Celtis tenuifolia* (dwarf hackberry), *Asclepias viridiflora* (green comet milkweed),

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Mirabilis albida (white four o'clock), *Scutellaria parvula* (small skullcap), *Penstemon cobaea* (cobaea beardtongue), and *Limnodea arkansana* (Ozark grass).

Global Similar Associations:

Quercus muehlenbergii / Schizachyrium scoparium - Bouteloua curtipendula Wooded Herbaceous Vegetation (CEGL005284)

Schizachyrium scoparium - Bouteloua curtipendula - Muhlenbergia cuspidata - Symphyotrichum sericeum Alkaline Herbaceous Vegetation (CEGL002403)

Schizachyrium scoparium - Sorghastrum nutans - Bouteloua curtipendula - Rudbeckia missouriensis - Hedyotis nigricans Wooded Herbaceous Vegetation (CEGL002398) Ozark Dolomite Glade of the Salem Plateau.

Global Related Concepts:

Limestone Glade (Nelson 1985) =

ELEMENT DISTRIBUTION

Buffalo National River Range: This association was sampled near Seven-mile Bend in Lower Buffalo Wilderness.

Global Range: This bluestem graminoid limestone glade community is found in the Ozarks of Missouri and southeastern Kansas in the United States.

Nations: US

States/Provinces: AR, KS:S1S2, MO:S2

TNC Ecoregions: 36:C, 37:C, 38:C

USFS Ecoregions (1994/95): 222Ab:CC?, 222Ac:CCC, 222Ag:CCC, 222Ah:CCP, 222Ak:CCC, 222Am:CCC, 222An:CC?, 251Cd:CCP, 251Ce:CCP, 251Ea:CCP

Federal Lands: NPS (Buffalo River)

ELEMENT SOURCES

Buffalo National River Plots: (2 plots): BUFF.706, BUFF.707.

Local Description Authors: M.J. Russo

Global Description Authors: P. Nelson, mod. D. Faber-Langendoen and M. Pyne

References: Lauver et al. 1999, Midwestern Ecology Working Group n.d., Nelson 1985

Ozark Dolomite Glade

***Schizachyrium scoparium - Sorghastrum nutans - Bouteloua curtipendula - Rudbeckia missouriensis - Hedyotis nigricans* Wooded Herbaceous Vegetation**

Little Bluestem - Yellow Indiangrass - Sideoats Grama - Missouri Orange Coneflower - Narrowleaf Summer Bluet Wooded Herbaceous Vegetation

Identifier: CEGL002398

NVC CLASSIFICATION

Division	Eastern North American Grassland, Meadow & Shrubland (2.B.2.Nc)
Macrogroup	Northern & Central Alvar & Glade (M124)
Group	Northern & Central Alkaline Glade (G179)
Association (Common name)	Ozark Dolomite Glade

ELEMENT CONCEPT

Global Summary: This bluestem graminoid dolomite glade community is found in the United States in the Ozark region of Missouri and Arkansas. Stands occur on moderate to steep slopes of dissected hills, steep valley slopes above large rivers and streams. Aspect is variable, but typically southern and western. Soils are rapidly drained (seasonally saturated in winter and spring) and shallow (0-40 cm). The parent material is dolomitic (dolostone) bedrock. The vegetation is dominated by medium-tall grasses and forbs, occasionally with stunted trees and shrubs. Stands are dominated *Schizachyrium scoparium* (little bluestem), *Bouteloua curtipendula* (sideoats grama), *Sporobolus heterolepis* (prairie dropseed), occurring with *Andropogon gerardii* (big bluestem), *Rudbeckia missouriensis* (Missouri orange coneflower), *Symphyotrichum sericeum* (western silver aster), *Buchnera americana* (American bluehearts), *Oenothera macrocarpa* (bigfruit evening-primrose), *Clinopodium arkansanum* (limestone calamint), *Sporobolus neglectus* (puffsheath dropseed), *Echinacea paradoxa* (Bush's purple coneflower), *Evolvulus nuttallianus* (shaggy dwarf morning-glory), *Leavenworthia uniflora* (Michaux's gladecress), *Clematis fremontii* (Fremont's leather flower), *Centaurea americana* (American star-thistle), *Valerianella ozarkana* (Benjamin Franklin bush), *Yucca glauca* (soapweed yucca), *Eriogonum longifolium* (longleaf buckwheat), *Acacia angustissima* (prairie acacia), *Phyllanthus polygonoides* (smartweed leaf-flower), *Cotinus obovatus* (American smoketree), *Stenosiphon linifolius* (false gaura), *Palafoxia callosa* (small palafox), *Centaurium texense* (Lady Bird's centaury), *Scutellaria bushii* (Bush's skullcap), *Penstemon cobaea* (cobaea beardtongue), *Marshallia caespitosa var. signata* (puffballs), *Thelesperma filifolium var. filifolium* (stiff greenthread), *Juniperus ashei* (Ashe's juniper), *Toxicodendron pubescens* (Atlantic poison-oak), and lichens *Lecanora muralis* (rim lichen), *Caloplaca saxicola* (orange lichen), *Placidium lachneum*, *Psora russellii* (Russell's fishscale lichen), *Placynthium nigrum* (blackthread lichen). Some additional forbs and grasses from Arkansas occurrences include *Asclepias amplexicaulis* (clasping milkweed), *Asclepias viridiflora* (green comet milkweed), *Coreopsis lanceolata* (lanceleaf tickseed), *Croton capitatus* (hogwort), *Desmanthus illinoensis* (Illinois bundleflower), *Grindelia lanceolata* (narrowleaf gumweed), *Hedyotis nigricans* (diamondflowers), *Liatris cylindracea* (Ontario blazing star), *Minuartia patula* (pitcher's

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stitchwort), *Mirabilis albida* (white four o'clock), *Onosmodium molle ssp. subsetosum* (softhair marbleseed), *Rhynchosia latifolia* (prairie snoutbean), and *Ruellia humilis* (fringeleaf wild petunia).

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This little bluestem glade community was sampled at six locations in the park. Sites range from moderate to steep midslope bedrock outcrops with generally southern or northern aspects. Soils are xeric, well-drained sandy loam, sand and clay loam. The unvegetated surface is made up of leaf litter (8-82% cover), exposed bedrock (0-30%), large rocks (1-25%), small rocks (0-15%), wood (0-1%), and bare soil (1-47%). Evidence of disturbance includes past fires.

Global Environment: Stands occur on moderate to steep slopes of dissected hills, steep valley slopes above large rivers and streams. Aspect is variable, but typically southern and western. Soils are rapidly drained (seasonally saturated in winter and spring) and shallow (0-40 cm). The parent material is dolomitic (dolostone) bedrock interspersed with abundant rock fragments and often dissected by horizontal layers of exposed dolomite bedrock (Nelson 1985).

VEGETATION DESCRIPTION

Buffalo National River Vegetation: A tree canopy may be absent or very sparse (5% cover), 5-20 m tall, and typically includes *Juniperus virginiana* (eastern red-cedar), sometimes along with *Fraxinus americana* (white ash), *Quercus muehlenbergii* (chinkapin oak), and *Quercus stellata* (post oak). The very sparse to moderate (10-50%) tall-shrub layer (2-5 m) and very sparse (5-30%) short-shrub layer (0.5-1 m) includes *Carya texana* (black hickory), *Celtis tenuifolia* (dwarf hackberry), *Cercis canadensis* (eastern redbud), *Diospyros virginiana* (common persimmon), *Frangula caroliniana* (Carolina buckthorn), *Fraxinus americana* (white ash), *Juniperus virginiana* (eastern red-cedar), *Quercus muehlenbergii* (chinkapin oak), *Quercus stellata* (post oak), *Rhus aromatica* (fragrant sumac), *Sideroxylon lanuginosum* (gum bully), *Symphoricarpos orbiculatus* (coralberry), *Ulmus alata* (winged elm), and others. The sparse to moderately dense (30-70%) herbaceous layer is dominated by graminoids *Andropogon gerardii* (big bluestem), *Danthonia spicata* (poverty oatgrass), *Dichanthelium* (rosette grass) spp., and *Schizachyrium scoparium* (little bluestem); additional common species may include *Dalea purpurea* (purple prairie clover), *Eriogonum longifolium* (longleaf buckwheat), *Eupatorium altissimum* (tall thoroughwort), *Euphorbia corollata* (flowering spurge), *Hedyotis nigricans* (diamondflowers), *Helianthus divaricatus* (woodland sunflower), *Lespedeza* (lespedeza) spp., *Manfreda virginica* (false aloe), *Scleria oligantha* (littlehead nutrush), and *Symphyotrichum patens* (late purple aster). Vines include *Parthenocissus quinquefolia* (Virginia creeper), *Smilax bona-nox* (saw greenbrier), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis aestivalis* (summer grape). This community also supports state-imperiled *Nemastylis nuttallii* (Nuttall's pleatleaf) and *Symphyotrichum sericeum* (western silver aster) and globally and state-vulnerable *Delphinium treleasei* (glade larkspur).

Global Vegetation: The vegetation is dominated by medium-tall grasses and forbs, occasionally with stunted trees and shrubs. Stands are dominated by *Schizachyrium scoparium* (little bluestem), *Bouteloua curtipendula* (sideoats grama), *Sporobolus heterolepis* (prairie dropseed), occurring with *Andropogon gerardii* (big bluestem), *Rudbeckia missouriensis* (Missouri orange coneflower), *Symphyotrichum sericeum* (western silver aster), *Buchnera americana* (American bluehearts), *Oenothera macrocarpa* (bigfruit evening-primrose), *Clinopodium arkansanum* (limestone calamint), *Sporobolus neglectus* (puffsheath dropseed), *Echinacea paradoxa* (Bush's purple coneflower), *Evolvulus nuttallianus* (shaggy dwarf morning-glory), *Leavenworthia uniflora* (Michaux's gladecress), *Clematis fremontii* (Fremont's leather flower), *Centaurea americana* (American star-thistle), *Valerianella ozarkana* (Benjamin Franklin bush), *Yucca glauca* (soapweed yucca), *Eriogonum longifolium* (longleaf buckwheat), *Acacia angustissima* (prairie acacia), *Phyllanthus polygonoides* (smartweed leaf-flower), *Cotinus obovatus* (American smoketree), *Stenosiphon linifolius* (false gaura), *Palafoxia callosa* (small palafox), *Centaurium texense* (Lady Bird's centaury), *Scutellaria bushii* (Bush's skullcap), *Penstemon cobaea* (cobaea beardtongue), *Marshallia caespitosa var. signata* (puffballs), *Thelesperma filifolium var. filifolium* (stiff greenthread), *Juniperus ashei* (Ashe's juniper), *Toxicodendron pubescens* (Atlantic poison-oak), and lichens (*Lecanora muralis* (rim lichen), *Caloplaca saxicola* (orange lichen), *Placidium lachneum*, *Psora russellii* (Russell's fishscale lichen), *Placynthium nigrum* (blackthread lichen)) (Nelson 1985). Some additional forbs and grasses from Arkansas occurrences include *Asclepias amplexicaulis* (clasping milkweed), *Asclepias viridiflora* (green comet milkweed), *Coreopsis lanceolata* (lanceleaf tickseed), *Croton capitatus* (hogwort), *Desmanthus illinoensis* (Illinois bundleflower), *Grindelia lanceolata* (narrowleaf gumweed), *Hedyotis nigricans* (diamondflowers), *Liatris cylindracea* (Ontario blazing star), *Minuartia patula* (pitcher's stitchwort), *Mirabilis albida* (white four o'clock), *Onosmodium molle ssp. subsetosum* (softhair marbleseed), *Rhynchosia latifolia* (prairie snoutbean), and *Ruellia humilis* (fringeleaf wild petunia).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Juniperus virginiana* (eastern red-cedar)
Tree canopy	Broad-leaved deciduous tree	*Quercus muehlenbergii* (chinkapin oak), *Quercus stellata* (post oak)
Shrub/sapling (tall & short)	Needle-leaved shrub	*Juniperus virginiana* (eastern red-cedar)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Fraxinus americana* (white ash)
Short shrub/sapling	Broad-leaved deciduous shrub	*Celtis tenuifolia* (dwarf hackberry), *Rhus aromatica* (fragrant sumac), *Symphoricarpos orbiculatus* (coralberry)
Short shrub/sapling	Broad-leaved evergreen shrub	*Sideroxylon lanuginosum* (gum bully)

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Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem), *Danthonia spicata* (poverty oatgrass), *Schizachyrium scoparium* (little bluestem)

CHARACTERISTIC SPECIES

Buffalo National River: *Andropogon gerardii* (big bluestem), *Carya texana* (black hickory), *Celtis tenuifolia* (dwarf hackberry), *Danthonia spicata* (poverty oatgrass), *Fraxinus americana* (white ash), *Juniperus virginiana* (eastern red-cedar), *Quercus muehlenbergii* (chinkapin oak), *Quercus stellata* (post oak), *Rhus aromatica* (fragrant sumac), *Schizachyrium scoparium* (little bluestem), *Sideroxylon lanuginosum* (gum bully), *Symphoricarpos orbiculatus* (coralberry)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Delphinium treleasei* (glade larkspur, globally and state-vulnerable, G3), *Nemastylis nuttallii* (Nuttall's pleatleaf, state-imperiled, G4), *Symphyotrichum sericeum* (western silver aster, state-imperiled, G5); **Exotic/Invasive**: *Lespedeza cuneata* (sericea lespedeza, exotic, Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (24-Oct-2002). This dolomite glade community is found in the United States in the Ozark region of Missouri and Arkansas. Stands occur in relatively restricted dry, thin soil dolostone habitats on moderate to steep slopes of dissected hills, steep valley slopes above large rivers and streams. Over 200 occurrences and 6000 acres have been documented in Missouri alone. At least two-thirds are A- or B-ranked. Many are protected in a variety of state natural areas, state parks, and other management units that include management of this type for its biodiversity value. Further work on its status in Arkansas is needed.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: Concept of this type is based on the Missouri state type - dolomite glade (Nelson 1985). Missouri may split this type into three subtypes: (1) White River section: large glades (>10 acres) on Cotter Dolomite. Several endemics are present, including *Penstemon cobaea* (cobaea beardtongue). (2) Upper/Lower Ozark section: small to medium glades (1-5 acres) on Gasconade and Eminence Dolomite. Indicator species include *Scutellaria bushii* (Bush's skullcap). (3) Ozark Border Section along the Missouri River: medium glades (5-20 acres) on Jefferson City-Cotter Dolomite. Indicator species include *Clematis fremontii* (Fremont's leather flower). (M. Leahy pers. comm. 1999)
Global Similar Associations:
Quercus muehlenbergii / Schizachyrium scoparium - Bouteloua curtipendula Wooded Herbaceous Vegetation (CEGL005284)
Schizachyrium scoparium - Bouteloua curtipendula - Rudbeckia missouriensis - Mentzelia oligosperma Wooded Herbaceous Vegetation (CEGL002251) Ozark Limestone Glade of the Springfield Plateau.
Global Related Concepts:
Dolomite Glade (Nelson 1985) **?**

ELEMENT DISTRIBUTION

Buffalo National River Range: This little bluestem glade community was sampled near Buffalo Point (Overlook Trail), Tyler Bend and at Lower Buffalo Wilderness Turkey Mountain.
Global Range: This bluestem graminoid dolomite glade community is found in the United States in the Ozarks region of Missouri and Arkansas. Range extent is about 120,000 square km (the area of USFS Subsection 222A).
Nations: US
States/Provinces: AR, MO:S3
TNC Ecoregions: 38:C
USFS Ecoregions (1994/95): 222Aa:CCC, 222Ab:CCC, 222Ac:CCC, 222Ad:CCC, 222Ae:CCC, 222Af:CCC, 222Ag:CCC, 222Aj:CCC, 222Ak:CCC, 222Al:CCC, 222Am:CCC, 222An:CC?, 251:?
Federal Lands: NPS (Buffalo River, Ozark Riverways); USFS (Mark Twain, Ozark)

ELEMENT SOURCES

Buffalo National River Plots: (6 plots): BUFF.114, BUFF.157, BUFF.158, BUFF.159, BUFF.719, BUFF.739.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: P. Nelson, mod. D. Faber-Langendoen
References: Chastain et al. 2006, Foti 1994b, Leahy pers. comm., Midwestern Ecology Working Group n.d., Nelson 1985, Nigh et al. 2000

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2.B.2.Ne. Southeastern North American Grassland & Shrubland

M307. Southeastern Ruderal Grassland & Shrubland

G583. Southeastern Old Field

Successional Broomsedge Vegetation

***Andropogon virginicus var. virginicus* Herbaceous Vegetation**
Broomsedge Bluestem Herbaceous Vegetation
Identifier: CEGL004044

NVC CLASSIFICATION

Division	Southeastern North American Grassland & Shrubland (2.B.2.Ne)
Macrogroup	Southeastern Ruderal Grassland & Shrubland (M307)
Group	Southeastern Old Field (G583)
Association (Common name)	Successional Broomsedge Vegetation

ELEMENT CONCEPT

Global Summary: This association includes herbaceous-dominated vegetation that has been anthropogenically altered and/or maintained, especially on old fields and pastures. Examples support predominately native species or a mixture of native and exotic species, one of the most dominant or characteristic species being *Andropogon virginicus var. virginicus* (broomsedge bluestem). *Lolium pratense* (meadow ryegrass) can dominate fields early in the season. This is a very common and wide-ranging association that can be quite variable in terms of species composition. Additional components are other perennial grasses and herbaceous species, most with pioneer or weedy tendencies, the exact composition of which will vary with geography, management history, and habitat.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This cultivated meadow association was sampled once in the park. The site is a gently sloping interfluve with dry-mesic, moderately well-drained silt loam soil. The unvegetated surface is dominated by bare soil (80% cover) with some small rocks (18%) and leaf litter (2%). Evidence of disturbance includes past clearing (and possibly planting), trails, fire (most leaf litter may have been removed by a recent fire), and the presence of exotic plant species.
Global Environment: This vegetation typically occurs on old fields, pastures, and rocky sites. It will persist indefinitely under a regular mowing regime, e.g., in powerline corridors.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: This association is dominated by the herbaceous layer (100% cover). However, there may be a sparse (20%) short-shrub layer dominated by *Rhus copallinum* (winged sumac) and *Rhus glabra* (smooth sumac). *Andropogon gerardii* (big bluestem) dominates the herbaceous layer. Additional herbs (in order of abundance) include *Penstemon digitalis* (talus slope penstemon), *Panicum virgatum* (switchgrass), *Dichanthelium laxiflorum* (openflower rosette grass), *Lespedeza procumbens* (trailing lespedeza), *Pycnanthemum tenuifolium* (narrowleaf mountainmint), *Rubus flagellaris* (northern dewberry), *Vernonia baldwinii* (Baldwin's ironweed), and many others at low cover.
Global Vegetation: Stands of this community are dominated by *Andropogon virginicus var. virginicus* (broomsedge bluestem), sometimes codominant with *Lolium pratense* (meadow ryegrass). Associated species vary with geography and habitat and include typical pioneer species. Species with high cover values in plot samples attributed to this type include *Tridens flavus* (purpletop tridens), *Setaria parviflora* (marsh bristlegrass), *Eragrostis spectabilis* (purple lovegrass), and *Panicum anceps* (beaked panicgrass) (NatureServe Ecology unpubl. data). On the eastern Highland Rim of Tennessee (Arnold Air Force Base), associated species include *Diodia teres* (poorjoe), *Aristida dichotoma* (churchmouse threeawn), *Aristida oligantha* (prairie threeawn), *Packera anonyma* (Small's ragwort), *Paspalum laeve* (field paspalum), *Lespedeza virginica* (slender lespedeza), and *Plantago virginica* (Virginia plantain). *Rubus argutus* (sawtooth blackberry) and *Smilax* (greenbrier) spp. may be locally abundant but are not dominant. In clearcuts, *Schizachyrium scoparium* (little bluestem), *Danthonia spicata* (poverty oatgrass), and *Dichanthelium* (rosette grass) spp. are also common, as are occasional *Quercus* (oak) spp. and *Rubus argutus* (sawtooth blackberry). The plot at Shiloh National Military Park (western Tennessee) was a mowed field of mostly native species, dominated by *Andropogon virginicus var. virginicus* (broomsedge bluestem). *Paspalum setaceum* (thin paspalum) and *Tridens flavus* (purpletop tridens) were codominant (with less cover). Other herbaceous plants with high cover values were *Setaria parviflora* (marsh bristlegrass), *Diodia teres* (poorjoe), *Schizachyrium scoparium* (little bluestem), and less common were *Packera anonyma* (Small's ragwort), *Sorghum halepense* (Johnsongrass), and *Cyperus retrorsus* (pine barren flatsedge). At less than 1% cover were *Polypremum procumbens* (juniper leaf), *Oxalis stricta* (common yellow oxalis), *Eragrostis spectabilis* (purple lovegrass), *Salvia lyrata* (lyreleaf sage), *Solanum carolinense* (Carolina horsenettle), *Digitaria sanguinalis* (hairy crabgrass), *Panicum anceps* (beaked panicgrass), *Croton willdenowii* (Willdenow's croton), *Trifolium pratense* (red clover), *Kummerowia striata* (Japanese clover), *Coreopsis pubescens* (star tickseed), *Plantago lanceolata* (narrowleaf plantain), and *Mecardonia acuminata* (axilflower). At only a trace amount of cover were *Conyza canadensis* (Canadian horseweed), *Acalypha virginica* (Virginia threeseed mercury), *Solidago* (goldenrod) sp., *Erigeron annuus* (eastern daisy fleabane), *Sida spinosa* (prickly fanpetals), *Hypericum drummondii* (nits and lice), *Polygala verticillata* (whorled milkwort), *Eupatorium*

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capillifolium (dogfennel), *Passiflora incarnata* (purple passionflower), and *Asclepias amplexicaulis* (clasping milkweed). In West Virginia, common associates include *Sorghastrum nutans* (Indiangrass), *Dichanthelium clandestinum* (deertongue), *Anthoxanthum odoratum* (sweet vernalgrass), *Phleum pratense* (timothy), *Dactylis glomerata* (orchardgrass), *Daucus carota* (Queen Anne's lace), *Lotus corniculatus* (bird's-foot trefoil), *Trifolium pratense* (red clover), *Leucanthemum vulgare* (oxeye daisy), *Solidago canadensis* (Canada goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), and *Solidago nemoralis* (gray goldenrod).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Andropogon virginicus* var. *virginicus* (broomsedge bluestem)

CHARACTERISTIC SPECIES

Buffalo National River: *Andropogon gerardii* (big bluestem)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Exotic/Invasive: *Lespedeza cuneata* (sericea lespedeza, exotic, Medium), *Potentilla recta* (sulphur cinquefoil, exotic, High/Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (8-Aug-2000). This is a ruderal community and represents vegetation resulting from succession following anthropogenic disturbance of an area. It is not a conservation priority for its own sake and does not receive a conservation rank.

CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong
Global Comments: Phenology can affect apparent composition: in West Virginia, fields visited early in the season had high cover of *Lolium pratense* (meadow ryegrass), while those sampled later in the season were dominated by *Andropogon virginicus* (broomsedge bluestem).
Global Similar Associations:
Rhus copallinum - Andropogon virginicus Successional Herbaceous Vegetation (CEGL004035)
Schizachyrium scoparium - Andropogon (gyrans, ternarius, virginicus) Herbaceous Vegetation (CEGL007707)
Global Related Concepts:
Old fields (Vanderhorst 2001a) **?**
Successional / Modified Terrestrial Herbaceous Vegetation (Fleming et al. 2006) **>**

ELEMENT DISTRIBUTION

Buffalo National River Range: This association was sampled just west of Collier Homestead Historic Site parking area at Tyler Bend.
Global Range: This community ranges throughout most or all of the southeastern United States, extending north to Virginia and West Virginia.
Nations: US
States/Provinces: AL, AR, GA, IL, IN, KY, LA, MO?, MS, NC, OK, SC, TN, TX, VA, WV
TNC Ecoregions: 31:C, 32:C, 38:C, 39:C, 40:C, 41:C, 42:C, 43:C, 44:C, 50:C, 51:P, 52:C, 53:C, 56:C, 57:C, 59:C
USFS Ecoregions (1994/95): 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Cg:CCC, 222Eg:CCC, 231Aa:CCC, 231Ba:CCC, 231Be:CCC, 231Bi:CCC, 231Cc:CCC, 231Fa:CCP, 231Fb:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232B:CC, 232Ce:CCC, 232F:CC, 255Da:CCC, 255Dc:CCC, M221Aa:CCC, M221Ab:CCC, M221Ba:CC?, M221Bb:CCC, M221Bd:CC?, M221Ca:CPP, M221Cb:CPP, M221Cc:CPP, M221Ce:CPP, M221Da:CCC, M221Db:CCC, M221Dc:CCP, M221Dd:CCP, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC
Federal Lands: DOD (Arnold, Fort Benning, Fort Gordon); NPS (Abe Lincoln Birthplace, Appalachian Trail (Central Appalachians), Big South Fork, Buffalo River, Chattahoochee River, Chickamauga-Chattanooga?, Cowpens, Fort Donelson, Kings Mountain, Little River Canyon, Mammoth Cave, Natchez Trace, Ninety Six, Shiloh, Stones River); USFS (Cherokee, George Washington, Jefferson, Oconee?, Ouachita (Coastal Plain)?, Ouachita (Mountains)?, Ouachita?, Ozark?, Talladega (Oakmulgee)?, Talladega (Talladega)?, Talladega?, Tuskegee?); USFWS (Anahuac, Big Boggy?, Brazoria)

ELEMENT SOURCES

Buffalo National River Plots: (1 plot): BUFF.134.
Local Description Authors: M.J. Russo
Global Description Authors: A.S. Weakley, mod. C.W. Nordman and S.C. Gawler

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References: Fleming and Coulling 2001, Fleming and Patterson 2011a, Fleming et al. 2006, Hoagland 2000, NatureServe Ecology - Southeastern U.S. unpubl. data, Nordman 2004, Penfound 1953, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, TNC 1998a, Tarr et al. 1980, Vanderhorst 2001a, Vanderhorst and Streets 2006, White and Madany 1978

Cultivated Meadow

***Lolium (arundinaceum, pratense)* Herbaceous Vegetation**
(Tall Fescue, Meadow Ryegrass) Herbaceous Vegetation
Identifier: CEGL004048

NVC CLASSIFICATION

Division	Southeastern North American Grassland & Shrubland (2.B.2.Ne)
Macrogroup	Southeastern Ruderal Grassland & Shrubland (M307)
Group	Southeastern Old Field (G583)
Association (Common name)	Cultivated Meadow

ELEMENT CONCEPT

Global Summary: This association includes grassland pastures and hayfields, more-or-less cultural, though sometimes no longer actively maintained. The dominant species in this type are the European "tall or meadow fescues" of uncertain and controversial generic placement. Several other exotic grasses (*Agrostis gigantea* (redtop), *Dactylis glomerata* (orchardgrass), *Holcus lanatus* (common velvetgrass), *Phleum pratense* (timothy), and *Poa pratensis* (Kentucky bluegrass), for example) are common associates. These communities are sometimes nearly monospecific but can also be very diverse and contain many native as well as exotic species of grasses, sedges, and forbs. Exotic forbs include the legumes *Lespedeza cuneata* (sericea lespedeza), *Trifolium campestre* (field clover), *Trifolium hybridum* (alsike clover), *Trifolium pratense* (red clover), and *Trifolium repens* (white clover), as well as *Achillea millefolium* (common yarrow), *Calystegia sepium* (hedge false bindweed), *Daucus carota* (Queen Anne's lace), *Leucanthemum vulgare* (oxeye daisy), *Oxalis stricta* (common yellow oxalis), and *Plantago lanceolata* (narrowleaf plantain). Common native herbs include *Apocynum cannabinum* (Indianhemp), *Desmodium canescens* (hoary ticktrefoil), *Dichanthelium clandestinum* (deertongue), *Erigeron annuus* (eastern daisy fleabane), *Fragaria virginiana* (Virginia strawberry), *Potentilla simplex* (common cinquefoil), *Solanum carolinense* (Carolina horsenettle), *Solidago canadensis* (Canada goldenrod), and *Verbesina occidentalis* (yellow crownbeard). This vegetation is currently defined for the Central and Southern Appalachians, Ozarks, Ouachita Mountains, and parts of the Piedmont and Interior Low Plateau, but it is possible throughout much of the eastern United States and southern Canada.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.
Global Environment: This association includes grassland pastures and hayfields, more-or-less cultural, though sometimes no longer actively maintained. It occurs in areas which have been cleared in the past, including abandoned farmlands, strip mines, and other areas disturbed by human activities.

VEGETATION DESCRIPTION

Buffalo National River Vegetation: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.
Global Vegetation: This association represents early-successional herbaceous and herb-shrub vegetation dominated by or having a large component of exotic grasses and legumes. The dominant species in this association are the European "tall or meadow fescues" (*Lolium* (ryegrass) spp.). These communities are sometimes nearly monospecific but can also be very diverse and contain many native species of grasses, sedges, and forbs. Woody encroachment is restricted to low cover by *Toxicodendron radicans* (eastern poison-ivy) and species of *Rubus* (blackberry), both of which become more abundant in older stands. Scattered individuals of various shrubs may be present, including *Crataegus crus-galli* (cockspur hawthorn), *Fraxinus pennsylvanica* (green ash), *Fraxinus americana* (white ash), *Rosa multiflora* (multiflora rose), *Robinia pseudoacacia* (black locust), *Cornus florida* (flowering dogwood), *Elaeagnus umbellata* (autumn olive), *Sambucus canadensis* (common elderberry), and *Sassafras albidum* (sassafras). In the Central Appalachians and northern Cumberlands, the dominant exotic grasses include *Agrostis gigantea* (redtop), *Dactylis glomerata* (orchardgrass), *Holcus lanatus* (common velvetgrass), *Lolium pratense* (meadow ryegrass), *Phleum pratense* (timothy), and *Poa pratensis* (Kentucky bluegrass). Exotic forbs include the legumes *Lespedeza cuneata* (sericea lespedeza), *Trifolium campestre* (field clover), *Trifolium hybridum* (alsike clover), *Trifolium pratense* (red clover), and *Trifolium repens* (white clover), as well as *Achillea millefolium* (common yarrow), *Calystegia sepium* (hedge false bindweed), *Daucus carota* (Queen Anne's lace), *Leucanthemum vulgare* (oxeye daisy), *Oxalis stricta* (common yellow oxalis), and *Plantago lanceolata* (narrowleaf plantain). Common native herbs include *Apocynum cannabinum* (Indianhemp), *Desmodium canescens* (hoary ticktrefoil), *Dichanthelium clandestinum* (deertongue), *Erigeron annuus* (eastern daisy fleabane), *Fragaria virginiana* (Virginia strawberry), *Potentilla simplex* (common cinquefoil), *Solanum carolinense* (Carolina horsenettle), *Solidago canadensis* (Canada goldenrod), and *Verbesina occidentalis* (yellow crownbeard). In the Black Belt region of Alabama and Mississippi, it is commonly found in mixture with *Paspalum dilatatum* (dallisgrass) (Bransby n.d.), and the exotic *Bromus tectorum* (cheatgrass) may be present in stands.

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MOST ABUNDANT SPECIES

Global Stratum	Lifeform	Species
Herb (field)	Graminoid	*Agrostis gigantea* (redtop), *Phleum pratense* (timothy)

CHARACTERISTIC SPECIES

Global: *Achillea millefolium* (common yarrow), *Apocynum cannabinum* (Indianhemp), *Calystegia sepium* (hedge false bindweed), *Dactylis glomerata* (orchardgrass), *Daucus carota* (Queen Anne's lace), *Desmodium canescens* (hoary ticktrefoil), *Dichanthelium clandestinum* (deertongue), *Erigeron annuus* (eastern daisy fleabane), *Fragaria virginiana* (Virginia strawberry), *Holcus lanatus* (common velvetgrass), *Lespedeza cuneata* (sericea lespedeza), *Leucanthemum vulgare* (oxeye daisy), *Oxalis stricta* (common yellow oxalis), *Plantago lanceolata* (narrowleaf plantain), *Poa pratensis* (Kentucky bluegrass), *Potentilla simplex* (common cinquefoil), *Solanum carolinense* (Carolina horsenettle), *Solidago canadensis* (Canada goldenrod), *Trifolium hybridum* (alsike clover), *Trifolium pratense* (red clover), *Trifolium repens* (white clover)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Exotic/Invasive: *Lespedeza cuneata* (sericea lespedeza, exotic, Medium), *Potentilla recta* (sulphur cinquefoil, exotic, High/Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (invasive) (5-Jan-2000). This vegetation is dominated by an exotic species, is of anthropogenic origin, and is thus not a conservation priority.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: *Lolium pratense* (meadow ryegrass) and *Lolium arundinaceum* (tall fescue) are two closely related species which were traditionally treated as *Festuca pratensis* and *Festuca arundinacea*, and could alternately be treated as *Schedonorus pratensis* and *Schedonorus arundinaceus*. Conversion to Kartesz (1999) standard has necessitated the shift to the *Lolium* (ryegrass) names from *Festuca* (fescue).
Global Similar Associations:
Dactylis glomerata - Phleum pratense - Festuca spp. - *Solidago* spp. Herbaceous Vegetation (CEGL006107)
Schizachyrium scoparium - (Andropogon virginicus) - Solidago spp. Herbaceous Vegetation (CEGL006333)
Global Related Concepts:
Festuca pratensis - (Holcus lanatus) - Solidago canadensis herbaceous vegetation (Vanderhorst 2001b) =
Cleared Areas (Schmalzer and DeSelm 1982) >

ELEMENT DISTRIBUTION

Buffalo National River Range: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.
Global Range: This association is currently documented from the southern half of the Central Appalachians through the Gulf Coastal Plain and west to the Ozarks and Ouachitas. It is possible throughout much of the eastern United States.
Nations: US
States/Provinces: AL, AR, GA, KY, MD, MO, MS, NC, OK, SC, TN, VA, WV
TNC Ecoregions: 38:C, 39:C, 40:P, 43:C, 44:C, 50:C, 51:C, 52:C, 57:C, 59:C
USFS Ecoregions (1994/95): 221Hc:CCC, 221He:CCC, 222Eg:CCC, 231Ae:CCC, 231Ba:CCC, 231Bh:CCC, 231Bi:CCC, M221Cb:CCC, M221Cd:CCC, M221Dc:CCC, M221Dd:CCC, M222Ab:CCC, M231A:CC
Federal Lands: BIA (Eastern Band of Cherokee); NPS (Abe Lincoln Birthplace, Appalachian Trail (Southern Blue Ridge)?, Big South Fork, Blue Ridge Parkway, Buffalo River, Carl Sandburg Home, Chickamauga-Chattanooga, Cowpens, Cumberland Gap, Fort Donelson, Great Smoky Mountains, Guilford Courthouse, Kings Mountain, Little River Canyon, Mammoth Cave, Natchez Trace, New River Gorge, Ninety Six, Obed River, Russell Cave, Shiloh, Stones River, Thomas Stone, Vicksburg); USFS (Cherokee, Ouachita, Ouachita (Coastal Plain)?, Ouachita (Mountains), Ozark)

ELEMENT SOURCES

Buffalo National River Plots: None.
Local Description Authors: M.J. Russo
Global Description Authors: A.S. Weakley, mod. S.C. Gawler
References: Bransby n.d., Heath et al. 1973, Hoagland 2000, Kartesz 1999, NatureServe Ecology - Southeastern U.S. unpubl. data, Nordman 2004, Schmalzer and DeSelm 1982, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst 2001b, Vanderhorst et al. 2007, White and Pyne 2003

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2.B.5. Temperate & Boreal Bog & Fen

2.B.5.Na. North American Bog & Fen

M061. Appalachian, Interior Plateau & Prairie Fen

G182. Interior Plateau Seepage Fen

Ozark Fen

(Carex interior, Carex lurida) - Carex leptalea - Parnassia grandifolia - Rhynchospora capillacea
Herbaceous Vegetation
(Inland Sedge, Shallow Sedge) - Bristly-stalked Sedge - Largeleaf Grass-of-Parnassus - Needle Beaksedge
Herbaceous Vegetation
Identifier: CEGL002404

NVC CLASSIFICATION

Division	North American Bog & Fen (2.B.5.Na)
Macrogroup	Appalachian, Interior Plateau & Prairie Fen (M061)
Group	Interior Plateau Seepage Fen (G182)
Association (Common name)	Ozark Fen

ELEMENT CONCEPT

Global Summary: This fen community type is found in the Ozarks region of the United States. Stands occurs on the sideslopes of hills in narrow valleys, bases of bluffs, rock ledges, and terraces, where the soil or substrate is saturated by calcareous groundwater seepage. Soils are mucky peat or mineral, with pH above 6.5, and very shallow (0-40 cm), depending on natural disturbance and slope. The parent material is a mixture of gravel and dolomite with fragments of deeply weathered bedrock present. The bedrock strata are exposed, especially in hanging fens where the slope is greater than 35 degrees. Hydrophytic plants dominate this mixed grass or sedge fen that is a complex of zoned vegetation. Type 1) saturated areas dominated by tussock sedges such as *Carex interior* (inland sedge) and *Carex lurida* (shallow sedge); Type 2) deep muck saturated areas, dominated by those sedges and by *Carex hystericina* (bottlebrush sedge), *Carex suberecta* (prairie straw sedge), and the shrub *Alnus serrulata* (hazel alder); Type 3) marly ooze areas dominated by *Carex leptalea* (bristly-stalked sedge), *Rhynchospora capillacea* (needle beaksedge), and *Scleria verticillata* (low nutrush); Type 4) drier areas or margins dominated by *Andropogon gerardii* (big bluestem), *Rudbeckia fulgida var. umbrosa* (orange coneflower), and *Parnassia grandifolia* (largeleaf grass of Parnassus). Characteristic species include *Menyanthes trifoliata* (buckbean) and *Pogonia ophioglossoides* (snakemouth orchid). Other species present in most examples include *Carex hystericina* (bottlebrush sedge), *Castilleja coccinea* (scarlet Indian paintbrush), *Fuirena simplex* (western umbrella-sedge), *Helenium autumnale* (common sneezeweed), *Lobelia siphilitica* (great blue lobelia), *Schoenoplectus americanus* (chairmaker's bulrush), *Scirpus atrovirens* (green bulrush), *Scirpus pendulus* (rufous bulrush), *Selaginella apoda* (meadow spikemoss), *Packera aurea* (golden ragwort), and *Oligoneuron rigidum var. rigidum* (stiff goldenrod). Deep muck fens may also contain *Thelypteris palustris var. pubescens* (eastern marsh fern), *Lysimachia quadriflora* (fourflower yellow loosestrife), *Selaginella eclipes* (hidden spikemoss), *Rudbeckia fulgida var. umbrosa* (orange coneflower), *Carex granularis* (limestone meadow sedge), *Oxypolis rigidior* (stiff cowbane), *Physocarpus opulifolius* (common ninebark), *Pedicularis lanceolata* (swamp lousewort), *Cardamine bulbosa* (bulbous bittercress), and *Viola cucullata* (marsh blue violet).

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This fen community was sampled once just north of CR 25 about 1.2 miles east of Highway 21. The site is part of a spring-fed seep that was impounded for a pond in the past, but which has subsequently become fully vegetated. Water still flows freely through part of it. Soil is permanently flooded, very poorly drained deep muck. The unvegetated surface is made up of standing water (95% cover), with some leaf litter (5%). Evidence of disturbance includes alteration of the natural hydrology by a pond levee and the presence of exotic plants.
Global Environment: This community occurs on the sideslopes or toeslopes of hills in narrow valleys, bases of bluffs, rock ledges, and terraces. It occurs on all aspects and on a slope of 5-45 degrees. The soil or substrate is saturated by groundwater seepage. The soil conditions are the result of the underlying substrate and vegetation. In this fen community, the soil moisture gradient ranges from moist to wet with seasonal fluctuations. The groundwater is calcareous. The soil is mucky peat or mineral, with pH above 6.5, and varies from very shallow (0-40 cm) to deep (>100 cm), depending on natural disturbance and slope. The parent material is a mixture of gravel and dolomite with fragments of deeply weathered bedrock present. The bedrock strata are exposed in more shallow soil examples, especially in hanging fens where the slope is greater than 35 degrees, they or may be undetectable in deeper muck examples (Nelson 1985).

VEGETATION DESCRIPTION

Buffalo National River Vegetation: Vegetation is predominantly herbaceous. However, in this example, there is a very sparse (5% cover) shrub layer (1-5 m tall) of *Fraxinus pennsylvanica* (green ash), *Juglans nigra* (black walnut), and *Symphoricarpos orbiculatus*

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(coralberry). The dense (80%) herbaceous layer is dominated by graminoids *Leersia* (cutgrass) sp., *Scirpus atrovirens* (green bulrush), *Typha latifolia* (broadleaf cattail), and *Lolium arundinaceum* (tall fescue) (exotic). Other species include *Carex frankii* (Frank's sedge), *Carex vulpinoidea* (fox sedge), *Juncus diffusissimus* (slimpod rush), *Mentha X piperita* (peppermint), *Mimulus ringens* (Allegheny monkeyflower) (state-imperiled), and *Mimulus ringens* (Allegheny monkeyflower). This community also supports state-imperiled *Carex shortiana* (Short's sedge).

Global Vegetation: Hydrophytic plants dominate this community. It is a mixed-grass or sedge fen that is composed of different types of vegetation. Type 1) saturated areas dominated by tussock sedges such as *Carex interior* (inland sedge) and *Carex lurida* (shallow sedge); Type 2) deep muck saturated areas, dominated by those sedges and by *Carex hystericina* (bottlebrush sedge), *Carex suberecta* (prairie straw sedge), and the shrub *Alnus serrulata* (hazel alder); Type 3) marly ooze areas dominated by *Carex leptalea* (bristly-stalked sedge), *Rhynchospora capillacea* (needle beaksedge), and *Scleria verticillata* (low nutrush); Type 4) drier areas or margins dominated by *Andropogon gerardii* (big bluestem), *Rudbeckia fulgida var. umbrosa* (orange coneflower), and *Parnassia grandifolia* (largeleaf grass of Parnassus). Characteristic species include *Menyanthes trifoliata* (buckbean) and *Pogonia ophioglossoides* (snakemouth orchid). Other species present in most examples include *Carex hystericina* (bottlebrush sedge), *Castilleja coccinea* (scarlet Indian paintbrush), *Fuirena simplex* (western umbrella-sedge), *Helenium autumnale* (common sneezeweed), *Lobelia siphilitica* (great blue lobelia), *Schoenoplectus americanus* (chairmaker's bulrush), *Scirpus atrovirens* (green bulrush), *Scirpus lineatus* (drooping bulrush), *Selaginella apoda* (meadow spikemoss), *Packera aurea* (golden ragwort), and *Oligoneuron rigidum var. rigidum* (stiff goldenrod). Deep muck fens may also contain *Thelypteris palustris var. pubescens* (eastern marsh fern), *Lysimachia quadriflora* (fourflower yellow loosestrife), *Selaginella eclipes* (hidden spikemoss), *Rudbeckia fulgida var. umbrosa* (orange coneflower), *Carex granularis* (limestone meadow sedge), *Oxypolis rigidior* (stiff cowbane), *Physocarpus opulifolius* (common ninebark), *Pedicularis lanceolata* (swamp lousewort), *Cardamine bulbosa* (bulbous bittercress), and *Viola cucullata* (marsh blue violet) (Nelson 1985, T. Nigh pers. comm. 1996).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Herb (field)	Forb	*Mimulus ringens* (Allegheny monkeyflower), *Typha latifolia* (broadleaf cattail)
Herb (field)	Graminoid	*Lolium arundinaceum* (tall fescue), *Scirpus atrovirens* (green bulrush)

Global

Stratum	Lifeform	Species
Herb (field)	Forb	*Parnassia grandifolia* (largeleaf grass of Parnassus), *Rudbeckia fulgida* var. *umbrosa* (orange coneflower)
Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem), *Carex interior* (inland sedge), *Carex leptalea* (bristly-stalked sedge), *Carex lurida* (shallow sedge), *Rhynchospora capillacea* (needle beaksedge), *Scleria verticillata* (low nutrush)

CHARACTERISTIC SPECIES

Buffalo National River: *Lolium arundinaceum* (tall fescue), *Mimulus ringens* (Allegheny monkeyflower), *Scirpus atrovirens* (green bulrush), *Typha latifolia* (broadleaf cattail)

Global: *Carex interior* (inland sedge), *Carex leptalea* (bristly-stalked sedge), *Carex lurida* (shallow sedge), *Menyanthes trifoliata* (buckbean), *Parnassia grandifolia* (largeleaf grass of Parnassus), *Pogonia ophioglossoides* (snakemouth orchid), *Rhynchospora capillacea* (needle beaksedge), *Rudbeckia fulgida* var. *umbrosa* (orange coneflower), *Scleria verticillata* (low nutrush)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Vulnerable: *Carex shortiana* (Short's sedge, state-imperiled, G5), *Mimulus ringens* (Allegheny monkeyflower, state-imperiled, G5); **Exotic/Invasive**: *Cerastium fontanum* (common mouse-ear chickweed, exotic), *Lolium arundinaceum* (tall fescue, exotic, High/Medium), *Melilotus officinalis* (yellow sweetclover, exotic, Medium/Low), *Mentha* x *piperita* (peppermint, exotic), *Polygonum hydropiper* (marshpepper knotweed, exotic), *Rumex crispus* (curly dock, exotic, Low/Insignificant), *Torilis arvensis* (spreading hedgeparsley, exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (22-Jun-1998). Although numerous sites of this community remain, many are threatened by overgrazing. This community may suffer permanent loss of water because of local hydrologic changes. In Arkansas, occurrences are 0.5- to 1-acre areas along streams with exposed cliffline and seepage (P. Hyatt pers. comm.).

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Buffalo National River Comments: The plot classified to this association at Buffalo National River does not include conservative indicator species and has also been dammed, grazed, and degraded (T. Foti).

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Global Comments: This community type is based largely on work by S. Orzell and others (1983, 1984, 1985). Although numerous sites of this community remain, many are threatened by overgrazing. This community may suffer permanent loss of water because of local hydrologic changes. In Arkansas, occurrences are 0.5- to 1-acre areas along streams with exposed cliffline and seepage (P. Hyatt pers. comm.). The composition of Arkansas occurrences may vary sufficiently from this description to warrant another association. *Carex interior* (inland sedge) is very restricted in Arkansas.

Global Similar Associations:
Alnus serrulata Saturated Southern Shrubland (CEGL003912)
Carex interior - Carex lurida - Andropogon gerardii - Parnassia grandifolia Herbaceous Vegetation (CEGL002416)
Carex lurida - Carex leptalea - Parnassia grandifolia - Juncus brachycephalus - (Xyris tennesseensis) Herbaceous Vegetation (CEGL004161)

Global Related Concepts:
Deep Muck Fen (Nelson 1985) **<**
Fen (Nelson 1985) **><**
IIE1b. Calcareous Fen Complex (Allard 1990) **>**
P5B2cI1a. *Parnassia grandifolia-Carex lurida* (Foti et al. 1994) **?**
Palustrine (Cowardin et al. 1979) **>**
Sedge-Shrub Fen (Orzell et al. 1985) **?**
Streamside Seep-Fen (Orzell et al. 1985) **?**

ELEMENT DISTRIBUTION

Buffalo National River Range: This fen community was sampled just north of CR 25 about 1.2 miles east of Highway 21.
Global Range: This fen community type is found in the Ozarks region of the United States, particularly in the central part of southern Missouri and Arkansas.
Nations: US
States/Provinces: AR, MO
TNC Ecoregions: 38:C
USFS Ecoregions (1994/95): 222Aa:CCC, 222Ab:CCC, 222Ac:CCC, 222Ad:CCC, 222Ae:CCC, 222Af:CCC, 222Ag:CCC, 222Al:CCC, 222An:CCC, M222Aa:CCC
Federal Lands: DOD (Bull Shoals Lake); NPS (Buffalo River, Ozark Riverways); USFS (Mark Twain, Ozark)

ELEMENT SOURCES

Buffalo National River Plots: (1 plot): BUFF.033.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: P. Nelson, mod. J. Drake, D. Faber-Langendoen, and D. Ambrose 03-94, mod. D. Faber-Langendoen
References: Allard 1990, Chastain et al. 2006, Cowardin et al. 1979, Foti 1994b, Foti et al. 1994, Hyatt pers. comm., MNHP 2000, Midwestern Ecology Working Group n.d., Nelson 1985, Nigh et al. 2000, Nigh pers. comm., Orzell 1983, Orzell 1984, Orzell et al. 1985

2.B.6. Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

2.B.6.Na. Eastern North American Freshwater Wet Meadow, Riparian & Marsh

M165. Eastern North American Riverscour Wetland

G194. Northern & Central Riverscour Wetland

Interior Alder Shrubland

***Alnus serrulata* Interior Shrubland**
Hazel Alder Interior Shrubland
Identifier: CEGL003894

NVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.B.6.Na)
Macrogroup	Eastern North American Riverscour Wetland (M165)
Group	Northern & Central Riverscour Wetland (G194)
Association (Common name)	Interior Alder Shrubland

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ELEMENT CONCEPT

Global Summary: Stands of this temporarily flooded shrubland are dominated by *Alnus serrulata* (hazel alder). It occurs in the Interior Low Plateau, Piedmont, and Crosstimbers, and is possible in the upper West and East Gulf coastal plains. States of occurrence likely include Arkansas, Georgia, Louisiana, Oklahoma, Tennessee, and Kentucky. More information is needed to adequately describe and evaluate the distribution and rank of this association. It may require subdivision as more information becomes available.

ENVIRONMENTAL DESCRIPTION

Global Environment: Stands are typically found along the banks of streams and small rivers. The mechanical impacts of flowing water and hydrological effects of flooding serve to retard succession to tree-dominated vegetation types. These are successional stands which may be maintained in this condition indefinitely by these flooding events.

VEGETATION DESCRIPTION

Global Vegetation: Stands of this temporarily flooded shrubland are dominated by *Alnus serrulata* (hazel alder).

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (19-Sep-2001).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: This association may require subdivision as more information becomes available.
Global Related Concepts:
IIE3a. Riverside Shoal and Stream Bar Complex (Allard 1990) >

ELEMENT DISTRIBUTION

Global Range: This temporarily flooded shrubland occurs in the Interior Low Plateau, Piedmont, and Crosstimbers, and is possible in the upper West and East Gulf coastal plains. States of occurrence likely include Arkansas, Georgia, Louisiana, Oklahoma, Tennessee, and Kentucky.
Nations: US
States/Provinces: AR, GA, KY, LA, OK, TN
TNC Ecoregions: 32:P, 40:?, 43:P, 44:P, 53:P
USFS Ecoregions (1994/95): 222E:PP, 231B:PP, 231E:PP, 232B:PP, 255Ac:CCP, 255Ad:CCP
Federal Lands: NPS (Buffalo River)

ELEMENT SOURCES

Local Description Authors:
Global Description Authors: Southeastern Ecology Group
References: Allard 1990, Hoagland 2000, Little 1980b, Penfound 1953, Southeastern Ecology Working Group n.d., TDNH unpubl. data

Witch-hazel - Dogwood Gravel Wash

***Hamamelis vernalis - Cornus obliqua - Hypericum prolificum* Shrubland**
Ozark Witch-hazel - Pale Dogwood - Shrubby St. John's-wort Shrubland
Identifier: CEGL003898

NVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.B.6.Na)
Macrogroup	Eastern North American Riverscour Wetland (M165)
Group	Northern & Central Riverscour Wetland (G194)
Association (Common name)	Witch-hazel - Dogwood Gravel Wash

ELEMENT CONCEPT

Global Summary: This witch-hazel - dogwood gravel wash occurs in the Ozarks-Ouachita region of the United States. This shrubland occurs as narrow strips (1-10 m wide) in the upper scour zones of small to medium-sized streams. It is typically found in a substrate of loose cobble, but on larger streams and rivers may occur on bedrock shelves or alluvial silt, where it intergrades with other vegetation types. *Hamamelis vernalis* (Ozark witch-hazel), *Cornus obliqua* (silky dogwood), and *Hypericum prolificum* (shrubby St. Johnswort) are common and characteristic. Several other species may be locally abundant in the diverse microhabitats of this shrubland, including *Salix caroliniana* (coastal plain willow) in more open streambeds, *Leptopus phyllanthoides* (Missouri maidenbush) in drier scour zones, *Juniperus virginiana var. virginiana* (eastern red-cedar) in upper scour zones, *Ilex vomitoria* (yaupon) on bedrock and boulders on larger streams, and *Alnus serrulata* (hazel alder) and *Cephalanthus occidentalis* (common buttonbush) in low, wet areas. On more stable substrates *Platanus occidentalis* (American sycamore), *Acer rubrum* (red maple), and *Liquidambar styraciflua* (sweetgum) may be locally abundant. Other shrub and tree species that may occur include *Amorpha fruticosa* (desert false indigo), *Amorpha ouachitensis* (Ouachita false indigo), *Betula nigra* (river birch), *Crataegus* (hawthorn) spp., *Diospyros virginiana* (common persimmon), *Ulmus alata* (winged elm), *Hypericum prolificum* (shrubby St. Johnswort), *Ilex decidua*

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(possum-haw), *Styrax grandifolius* (bigleaf snowbell), and *Vaccinium virgatum* (smallflower blueberry). Herbaceous species include *Amsonia illustris* (Ozark bluestar), *Amsonia hubrichtii* (Hubricht's bluestar), *Ambrosia* (ragweed) spp., *Apios americana* (groundnut), *Boltonia diffusa* (smallhead doll's daisy), *Chasmanthium latifolium* (Indian woodoats), *Commelina erecta* (whitemouth dayflower), *Diodia virginiana* (Virginia buttonweed), *Eupatorium fistulosum* (trumpetweed), *Ludwigia decurrens* (wingleaf primrose-willow), *Polygonum pensylvanicum* (Pennsylvania smartweed), *Vernonia lettermannii* (narrowleaf ironweed), *Panicum virgatum* (switchgrass), *Panicum anceps* (beaked panicgrass), and *Perilla frutescens* (beefsteakplant) (exotic). *Trachelospermum difforme* (climbing dogbane) is a common vine of this community.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This witch-hazel gravel wash shrubland was sampled at two locations in the park. Sites are temporarily flooded, flat cobble bars and river channels. Soils are rapidly drained to well-drained sand. The unvegetated surface is dominated by small rocks (30-85% cover) with some leaf litter (10-25%), large rocks (0-35%), and bare soil (5-10%). Evidence of disturbance includes trails, flooding, and the presence of exotic plants.

Global Environment: This shrubland occurs as narrow strips (1-10 m wide) in the upper scour zones of small to medium-sized streams. It is typically found in a substrate of loose cobble, but on larger streams and rivers may occur on bedrock shelves or alluvial silt, where it intergrades with other vegetation types (J. Campbell pers. comm. 1994, D. Zollner pers. comm. 1994).

VEGETATION DESCRIPTION

Buffalo National River Vegetation: There is a very sparse (5-10% cover) tree canopy, 10-20 m tall, that may include *Betula nigra* (river birch) and *Platanus occidentalis* (American sycamore). However, this community is defined by the sparse (20%) tall-shrub layer (2-5 m) and very sparse (5-20%) short-shrub layer (0.5-1 m) of *Hamamelis vernalis* (Ozark witch-hazel); additional shrubs may include *Amorpha fruticosa* (desert false indigo), *Diospyros virginiana* (common persimmon) and *Liquidambar styraciflua* (sweetgum). The very sparse (5-20%) herbaceous layer includes *Toxicodendron radicans* (eastern poison-ivy) and *Amsonia illustris* (Ozark bluestar), and many others at very low cover.

Global Vegetation: *Hamamelis vernalis* (Ozark witch-hazel), *Cornus obliqua* (silky dogwood), and *Hypericum prolificum* (shrubby St. Johnswort) are common and characteristic. Several other species may be locally abundant in the diverse microhabitats of this shrubland, including *Salix caroliniana* (coastal plain willow) in more open streambeds, *Leptopus phyllanthoides* (Missouri maidenbush) in drier scour zones, *Juniperus virginiana var. virginiana* (eastern red-cedar) in upper scour zones, *Ilex vomitoria* (yaupon) on bedrock and boulders on larger streams, and *Alnus serrulata* (hazel alder) and *Cephalanthus occidentalis* (common buttonbush) in low, wet areas. On more stable substrates *Platanus occidentalis* (American sycamore), *Acer rubrum* (red maple), and *Liquidambar styraciflua* (sweetgum) may be locally abundant. Other shrub and tree species that may occur include *Amorpha fruticosa* (desert false indigo), *Amorpha ouachitensis* (Ouachita false indigo), *Betula nigra* (river birch), *Crataegus* (hawthorn) spp., *Diospyros virginiana* (common persimmon), *Ulmus alata* (winged elm), *Hypericum prolificum* (shrubby St. Johnswort), *Ilex decidua* (possum-haw), *Styrax grandifolius* (bigleaf snowbell), and *Vaccinium virgatum* (smallflower blueberry). Herbaceous species include *Amsonia illustris* (Ozark bluestar), *Amsonia hubrichtii* (Hubricht's bluestar), *Ambrosia* (ragweed) spp., *Apios americana* (groundnut), *Boltonia diffusa* (smallhead doll's daisy), *Chasmanthium latifolium* (Indian woodoats), *Commelina erecta* (whitemouth dayflower), *Diodia virginiana* (Virginia buttonweed), *Eupatorium fistulosum* (trumpetweed), *Ludwigia decurrens* (wingleaf primrose-willow), *Polygonum pensylvanicum* (Pennsylvania smartweed), *Vernonia lettermannii* (narrowleaf ironweed), *Panicum virgatum* (switchgrass), *Panicum anceps* (beaked panicgrass), and *Perilla frutescens* (beefsteakplant) (exotic). *Trachelospermum difforme* (climbing dogbane) is a common vine of this community (J. Campbell pers. comm. 1994, D. Zollner pers. comm. 1994).

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Betula nigra* (river birch)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Hamamelis vernalis* (Ozark witch-hazel)
Herb (field)	Forb	*Toxicodendron radicans* (eastern poison-ivy)

CHARACTERISTIC SPECIES

Buffalo National River: *Hamamelis vernalis* (Ozark witch-hazel), *Toxicodendron radicans* (eastern poison-ivy)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Exotic/Invasive: *Lespedeza cuneata* (sericea lespedeza, exotic, Medium), *Melilotus officinalis* (yellow sweetclover, exotic, Medium/Low), *Saponaria officinalis* (bouncingbet, exotic, Low/Insignificant), *Sorghum halepense* (Johnsongrass, exotic, High/Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3 (11-Jan-1998). This association is geographically restricted, occurring only in the Interior Highlands of Arkansas, Oklahoma, and Missouri. Degradation of streambanks due to grazing and other agricultural influences can have a detrimental impact on this community type.

CLASSIFICATION

Status: Standard

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Classification Confidence: 2 - Moderate
Global Comments: This association was defined from a TNC Arkansas Field Office survey in the Ouachita Mountains, Oklahoma and Arkansas, covering areas that are not part of the Ouachita National Forest (J. Campbell pers. comm. 1994, D. Zollner pers. comm. 1994). In Missouri it may be difficult to separate this type from *Salix caroliniana* (coastal plain willow) Temporarily Flooded Ozark Shrubland (CEGL007064). See also *Juniperus virginiana var. virginiana - Leptopus phyllanthoides - (Quercus nigra*, *Ilex vomitoria)* Shrubland (CEGL003942), which may be a zone of this type.
Global Similar Associations:
Alnus serrulata - Amorpha fruticosa Shrubland (CEGL007807)
Juniperus virginiana var. virginiana - Leptopus phyllanthoides - (Quercus nigra, Ilex vomitoria) Shrubland (CEGL003942)
Midwest Gravel Wash River Sparse Vegetation (CEGL002408)
Salix caroliniana Temporarily Flooded Ozark Shrubland (CEGL007064)

ELEMENT DISTRIBUTION

Buffalo National River Range: This witch-hazel gravel wash shrubland was sampled near Tyler Bend and 25 miles downstream of Erbie Campground.
Global Range: This witch-hazel - dogwood gravel wash occurs in the Ozarks-Ouachita region of the United States, from Missouri to Arkansas and Oklahoma.
Nations: US
States/Provinces: AR, MO, OK:S2
TNC Ecoregions: 38:C, 39:C
USFS Ecoregions (1994/95): 222Ag:CCC, 222An:CCC, 231Gb:CCC, M231A:CC
Federal Lands: NPS (Buffalo River, Ozark Riverways); USFS (Mark Twain, Ouachita, Ouachita (Mountains), Ozark)

ELEMENT SOURCES

Buffalo National River Plots: (2 plots): BUFF.125, BUFF.215.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: D. Zollner and J. Campbell
References: Campbell pers. comm., Chastain et al. 2006, Hoagland 1997, Hoagland 2000, Nigh et al. 2000, Southeastern Ecology Working Group n.d., Zollner pers. comm.

Carolina Willow Ozark Shrubland

***Salix caroliniana* Temporarily Flooded Ozark Shrubland**
Carolina Willow Temporarily Flooded Ozark Shrubland
Identifier: CEGL007064

NVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.B.6.Na)
Macrogroup	Eastern North American Riverscour Wetland (M165)
Group	Northern & Central Riverscour Wetland (G194)
Association (Common name)	Carolina Willow Ozark Shrubland

ELEMENT CONCEPT

Global Summary: This Carolina willow shrubland is found in the Ozark-Ouachita area of the south-central United States, with disjunct occurrences in the Interior Low Plateaus of Tennessee and possibly Kentucky. It accommodates riverside and streamside thickets dominated by *Salix caroliniana* (coastal plain willow) with temporarily flooded hydrology. This vegetation is often found along riverbanks, sand bars, gravel bars, and other wet sites. In the Ouachita Mountains, this shrubland occurs as a narrow fringe near the low-water level or in scour zones of most streams and rivers, where it is associated with a rocky substrate of cobbles or bedrock. This association includes stands in the interior; a different association represents similar vegetation in the coastal plains.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This Carolina willow - sycamore shrubland was sampled at three locations in the park near Tyler Bend. Sites include a gently sloping alluvial terrace (point bar at the river's edge), a somewhat steep sand and cobble bar, and a flat cobble bar of the Buffalo River. All sites are seasonally to temporarily flooded. Soils are well-drained sand. The unvegetated surface is made up of leaf litter (0-50% cover), large rocks (0-12%), small rocks (0-85%), wood (0-1%), and bare sand (3-96%). Evidence of disturbance includes flood debris in shrubs up to 2.5 m high, erosion, large burrows and sand throws, roads and trails, and the presence of exotic plants.
Global Environment: This broadly defined type accommodates *Salix caroliniana* (coastal plain willow) stands in a variety of temporarily flooded habitats, including riverside and streamside thickets, and sand/gravel/cobble bars. Some examples may be somewhat ruderal or successional, e.g., where *Salix caroliniana* (coastal plain willow) thickets develop along streams in pastures or other wet areas where the natural forest canopy has been removed.

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VEGETATION DESCRIPTION

Buffalo National River Vegetation: This community is dominated by the sparse to closed (10-100%) tall-shrub layer (2-5 m tall) of *Salix caroliniana* (coastal plain willow) which may include substantial amounts of *Platanus occidentalis* (American sycamore) as well as lesser amounts of *Acer negundo* (box-elder) and *Maclura pomifera* (osage orange). In addition, there may be a very sparse (10%) emergent tree layer (5-15 m) of *Acer negundo* (box-elder), *Acer saccharinum* (silver maple), *Platanus occidentalis* (American sycamore), and/or *Salix caroliniana* (coastal plain willow). The sparse to moderate (10-60%) short-shrub layer (0.5-1 m) is made up of saplings of species from the upper layers. The very sparse (5-20%) herbaceous layer includes *Ambrosia artemisiifolia* (annual ragweed), *Ambrosia trifida* (great ragweed), *Chasmanthium latifolium* (Indian woodoats), *Laportea canadensis* (Canadian woodnettle), *Polygonum virginianum* (jumpseed), *Rubus trivialis* (southern dewberry), *Toxicodendron radicans* (eastern poison-ivy), and *Xanthium strumarium* (rough cocklebur). Vines (5%) include *Ampelopsis cordata* (heartleaf peppervine) and *Vitis cinerea* (graybark grape). A total of 11 exotic species were recorded for the plot.
Global Vegetation: This is a broadly defined community covering thickets dominated by *Salix caroliniana* (coastal plain willow). A number of other shrub species may also be present, with some variability between geographic location and specific habitat type.

MOST ABUNDANT SPECIES

Buffalo National River

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Platanus occidentalis* (American sycamore), *Salix caroliniana* (coastal plain willow)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer negundo* (box-elder), *Maclura pomifera* (osage orange)

CHARACTERISTIC SPECIES

Buffalo National River: *Acer negundo* (box-elder), *Chasmanthium latifolium* (Indian woodoats), *Maclura pomifera* (osage orange), *Platanus occidentalis* (American sycamore), *Salix caroliniana* (coastal plain willow), *Toxicodendron radicans* (eastern poison-ivy), *Xanthium strumarium* (rough cocklebur)

OTHER NOTEWORTHY SPECIES

Buffalo National River: Exotic/Invasive: *Ailanthus altissima* (tree of heaven, exotic, Medium), *Calystegia sepium* (hedge false bindweed, exotic), *Chenopodium album* (lambsquarters, exotic), *Cynodon dactylon* (Bermudagrass, exotic, Medium/Low), *Glechoma hederacea* (ground ivy, exotic, Low), *Lespedeza cuneata* (sericea lespedeza, exotic, Medium), *Melilotus officinalis* (yellow sweetclover, exotic, Medium/Low), *Microstegium vimineum* (Nepalese browntop, exotic, High/Medium), *Perilla frutescens* (beefsteakplant, exotic, Low), *Saponaria officinalis* (bouncingbet, exotic, Low/Insignificant), *Sorghum halepense* (Johnsongrass, exotic, High/Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (4-Nov-2011). This is a relatively widespread type, which is naturally successional in its nature. Threats are very limited.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: Missouri suggests that this type be lumped with *Hamamelis vernalis - Cornus obliqua - Hypericum prolificum* Shrubland (CEGL003898) as part of a more complex gravel wash shrub type.
Global Similar Associations:
Alnus serrulata - Amorpha fruticosa Shrubland (CEGL007807)
Hamamelis vernalis - Cornus obliqua - Hypericum prolificum Shrubland (CEGL003898)
Salix caroliniana Temporarily Flooded Coastal Plain Shrubland (CEGL007052)
Salix interior - Salix eriocephala Sandbar Shrubland (CEGL005078)
Salix nigra / Phalaris arundinacea - Apocynum cannabinum Temporarily Flooded Shrubland (CEGL006065)
Global Related Concepts:
Gravel Bar Type (Dale and Kuroda 1979) ><
Gravel Wash (Nelson 1985) **?**

ELEMENT DISTRIBUTION

Buffalo National River Range: This Carolina willow - sycamore shrubland was sampled near Tyler Bend.
Global Range: This Carolina willow shrubland was originally described from the Ouachita Mountains of Arkansas, and has been documented from the Ozarks (Buffalo National River) as well as from scattered locations in the Interior Low Plateau of Tennessee and possibly Kentucky. A separate association accommodates similar vegetation in the Atlantic/East Gulf coastal plains.
Nations: US
States/Provinces: AR, KY?, MO?, TN
TNC Ecoregions: 38:C, 39:C, 44:P
USFS Ecoregions (1994/95): 222Aa:CCP, 222Ae:CC?, 222Af:CCP, 222Ag:CC?, 222An:CCC, M222Aa:CPP, M231:C

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Federal Lands: NPS (Buffalo River, Ozark Riverways, Stones River); USFS (Daniel Boone?, Ouachita, Ouachita (Mountains), Ozark)

ELEMENT SOURCES

Buffalo National River Plots: (3 plots): BUFF.121, BUFF.122, BUFF.126.
Local Description Authors: M.J. Russo and T. Foti
Global Description Authors: M. Pyne
References: Dale and Kuroda 1979, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1985, Nordman 2004, Southeastern Ecology Working Group n.d.

Ozark Riverine Gravel Flats

Ozark Riverine Cobble - Gravel Flats Sparse Vegetation
Ozark Riverine Cobble - Gravel Flats Sparse Vegetation
Identifier: CEGL007012

NVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.B.6.Na)
Macrogroup	Eastern North American Riverscour Wetland (M165)
Group	Northern & Central Riverscour Wetland (G194)
Association (Common name)	Ozark Riverine Gravel Flats

ELEMENT CONCEPT

Global Summary: This riverine gravel and cobble flats community is found in the Ozark and Ouachita regions of the United States. Stands occur along large and small rivers (including the Buffalo River in Arkansas) where gravel and cobble material has been deposited on the first terraces. The substrate consists of a mixture of cobbles, gravel and sand, and soils are poorly developed or absent. Sites can be flooded in spring. Vegetation is sparse and usually consists of scattered patches of annual grasses and annual or biennial forbs under 1 m tall. Shrubs are also scattered and uncommon, including *Lindera benzoin* (northern spicebush), *Alnus serrulata* (hazel alder), and *Hamamelis vernalis* (Ozark witch-hazel).

ENVIRONMENTAL DESCRIPTION

Global Environment: This community is found along major rivers where gravel has been deposited on the first terraces of Ozark and Ouachita rivers. The substrate consists of a mixture of cobbles, gravel and sand, and soils are poorly developed or absent. Sites can be flooded in spring.

VEGETATION DESCRIPTION

Global Vegetation: Vegetation is sparse and usually consists of a variable mixture of annual grasses, annual or biennial forbs, and annual vines under 1 m tall. Some native and exotic taxa that may be present include *Cyperus esculentus* (yellow nutsedge), *Lespedeza cuneata* (sericea lespedeza), *Arctium minus* (lesser burdock), *Cynodon dactylon* (Bermudagrass), *Digitaria* sp., *Lepidium virginicum* (Virginia pepperweed), *Ipomoea coccinea* (redstar), *Cuscuta gronovii* (scaldweed), *Pennisetum glaucum* (pearl millet), *Rubus trivialis* (southern dewberry), and *Diodia virginiana* (Virginia buttonweed) (NatureServe unpubl. data). Scattered taller plants may be present, including *Sorghum halepense* (Johnsongrass) and *Ambrosia artemisiifolia* (annual ragweed).

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (30-Mar-2011). This vegetation is well-distributed in the Buffalo River and its major tributaries. It is a disturbance-related type and not specifically of conservation concern. It depends on periodic flooding for its maintenance and renewal, and would be threatened by alteration of the natural hydrology of the river.

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Global Comments: This is a sparse vegetation type to represent open gravel/cobble bars, in contradistinction to shrub-dominated areas, such as *Hamamelis vernalis* - *Cornus obliqua* - *Hypericum prolificum* Shrubland (CEGL003898), *Salix caroliniana* (coastal plain willow) Temporarily Flooded Ozark Shrubland (CEGL007064), and others.
Global Similar Associations:
Great Plains Riverine Gravel Flats Sparse Vegetation (CEGL005223) of the Great Plains.
Riverine Sand Flats - Bars Sparse Vegetation (CEGL002049) of the Midwest and lower position.

ELEMENT DISTRIBUTION

Global Range: This riverine gravel flats community is found in the Ozark and Ouachita regions of Missouri, Arkansas and Oklahoma.
Nations: US
States/Provinces: AR, MO?, OK
TNC Ecoregions: 38:C, 39:P
USFS Ecoregions (1994/95): M231A:CC

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Federal Lands: NPS (Buffalo River, Ozark Riverways?); USFS (Ouachita (Mountains)?, Ouachita?, Ozark?)

ELEMENT SOURCES

Local Description Authors:
Global Description Authors: M. Pyne
References: NatureServe Ecology - Southeastern U.S. unpubl. data, Southeastern Ecology Working Group n.d.

M069. Eastern North American Wet Meadow & Marsh

G125. Eastern North American Freshwater Marsh

Bulrush - Cattail - Bur-reed Shallow Marsh

***Schoenoplectus tabernaemontani - Typha* spp. - (*Sparganium* spp., *Juncus* spp.)**
Herbaceous Vegetation
Softstem Bulrush - Cattail species - (Bur-reed species, Rush species) Herbaceous Vegetation
Identifier: CEGL002026

NVC CLASSIFICATION

Division	Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.B.6.Na)
Macrogroup	Eastern North American Wet Meadow & Marsh (M069)
Group	Eastern North American Freshwater Marsh (G125)
Association (Common name)	Bulrush - Cattail - Bur-reed Shallow Marsh

ELEMENT CONCEPT

Global Summary: This shallow marsh mixed emergent community ranges broadly over the midwestern United States and adjacent Canada. It is found in basin-like depressions, backwater areas of floodplains, and shallow margins of lakes or ponds. Soils are shallow to deep, very poorly drained, consisting of peats, mucks, or mineral materials, often found in alluvium. Vegetation varies from zones dominated by tall emergents 1-2 m tall to those with hydrophytic annual and perennial forbs <1 m tall. In the tall emergent zone, *Schoenoplectus tabernaemontani* (softstem bulrush), *Schoenoplectus fluviatilis* (river bulrush), *Schoenoplectus acutus* (hardstem bulrush), *Typha angustifolia* (narrowleaf cattail), and *Typha latifolia* (broadleaf cattail) may dominate, mixed with a variety of other herbaceous species, such as *Leersia oryzoides* (rice cutgrass), *Eleocharis palustris* (common spikerush), *Juncus* (rush) spp., and *Sparganium* (bur-reed) spp. The hydrophytic annual and perennial forb zone is dominated by *Alisma subcordatum* (American water plantain), *Alisma triviale* (northern water plantain), *Sagittaria latifolia* (broadleaf arrowhead), *Sparganium eurycarpum* (broadfruit bur-reed), *Pontederia cordata* (pickerelweed), along with *Bacopa rotundifolia* (disk water-hyssop) and *Heteranthera limosa* (blue mudplantain). Occasional floating-leaved aquatics are sometimes present, including *Azolla caroliniana* (Carolina mosquitofern), *Lemna* (duckweed) spp., *Spirodela polyrrhiza* (common duckmeat), and *Utricularia macrorhiza* (common bladderwort).

ENVIRONMENTAL DESCRIPTION

Global Environment: This community ranges broadly over the midwestern United States. It is found in basin-like depressions, backwater areas of floodplains and shallow margins of lakes or ponds. Soils are shallow to deep, very poorly drained, consisting of peats, mucks, or mineral materials, often found in alluvium (Lauver et al. 1999).

VEGETATION DESCRIPTION

Buffalo National River Vegetation: This association is found in a large beaver meadow in Boxley Valley which is spring-fed from adjacent uplands nearby. It is a mixture of *Schoenoplectus* (bulrush) sp., *Typha latifolia* (broadleaf cattail), *Carex* (sedge) spp., and *Sparganium* (bur-reed). Some other plants observed include *Bidens laevis* (smooth beggarticks), *Scirpus atrovirens* (green bulrush), *Panicum* (panicgrass) sp., *Boehmeria cylindrica* (small-spike false nettle), *Polygonum punctatum* (dotted smartweed) (?), *Lobelia siphilitica* (great blue lobelia), *Cyperus* (flatsedge) sp., *Mentha* (mint) sp., and *Impatiens capensis* (jewelweed).
Global Vegetation: Vegetation varies from zones dominated by tall emergents 1-2 m tall to those with hydrophytic annual and perennial forbs <1 m tall. In the tall emergent zone, *Schoenoplectus tabernaemontani* (softstem bulrush), *Schoenoplectus fluviatilis* (river bulrush), *Schoenoplectus acutus* (hardstem bulrush), *Typha angustifolia* (narrowleaf cattail), and *Typha latifolia* (broadleaf cattail) may dominate, mixed with a variety of other herbaceous species, such as *Leersia oryzoides* (rice cutgrass), *Eleocharis palustris* (common spikerush), *Juncus* (rush) spp., and *Sparganium* (bur-reed) spp. The hydrophytic annual and perennial forb zone is dominated by *Alisma subcordatum* (American water plantain), *Alisma triviale* (northern water plantain), *Pontederia cordata* (pickerelweed), *Sagittaria latifolia* (broadleaf arrowhead), and *Sparganium eurycarpum* (broadfruit bur-reed), along with *Bacopa rotundifolia* (disk water-hyssop) and *Heteranthera limosa* (blue mudplantain). Other species that may dominate locally include *Polygonum pensylvanicum* (Pennsylvania smartweed), *Polygonum amphibium var. emersum* (longroot smartweed), and *Polygonum lapathifolium* (curlytop knotweed). Occasional floating-leaved aquatics are sometimes present, including *Azolla caroliniana* (Carolina mosquitofern), *Lemna* (duckweed) spp., *Spirodela polyrrhiza* (common duckmeat), and *Utricularia macrorhiza* (common bladderwort) (Eggers and Reed 1987, Steinauer and Rolfsmeier 2000).

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (22-Jun-1998).

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CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Global Comments: This is a very broadly defined type that intergrades between wet meadows and deep marshes. Shaw and Fredine (1971) (in Eggers and Reed 1987) define shallow marsh as "soils that are saturated to inundated by standing water up to 15 cm in depth, throughout most of the growing season." Depending on the local topographic context, the type may or may not be extensive. Any number of types could be separated within this coarsely defined type, but it is not yet clear how best to make such distinctions (e.g., the forb-dominated portions, such as *Pontederia cordata* (pickerelweed) or *Sagittaria latifolia* (broadleaf arrowhead)). [See e.g., *Sagittaria latifolia - Leersia oryzoides* Herbaceous Vegetation (CEGL005240).] See also Lee et al. (1998), who separate out a *Sparganium eurycarpum* (broadfruit bur-reed) type. Taxonomically, *Schoenoplectus tabernaemontani* (softstem bulrush) is equivalent to former *Scirpus validus* (Kartesz 1999). In Minnesota, *Schoenoplectus acutus* (hardstem bulrush) may be the more common bulrush (R. Dana pers. comm. 1999). *Eleocharis* (spikerush) spp. can also be typical of this type. Dominant and characteristic plants should always be described from stands to allow for adequate characterization. In Nebraska, the pond marsh extends to south-central Nebraska (Steinauer and Rolfsmeier 2000).
Global Similar Associations:
Sagittaria latifolia - Leersia oryzoides Herbaceous Vegetation (CEGL005240)
Schoenoplectus acutus - (Schoenoplectus fluviatilis) Freshwater Herbaceous Vegetation (CEGL002225)
Typha spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229) This is the deep marsh equivalent of this type.
Typha spp. - *Schoenoplectus* spp. - Mixed Herbs Great Plains Herbaceous Vegetation (CEGL002228)
Global Related Concepts:
Scirpus validus herbaceous association (Hoagland 1997) **?**
Freshwater Marsh (Nelson 1985) **>**
Inland Emergent Marsh (Chapman et al. 1989) **>**
Mixed Emergent Marsh (Forest Section) (MNNHP 1993) **>**
Pond Marsh (Steinauer and Rolfsmeier 2003) **>**
Pond Marsh (Steinauer and Rolfsmeier 2000) **>**
Pond Marsh (Steinauer and Rolfsmeier 1997) **>**
Shallow Marsh (Faber-Langendoen 2001) **=**

ELEMENT DISTRIBUTION

Global Range: This shallow marsh mixed emergent community ranges broadly over the midwestern United States and adjacent Canada, from Ohio and Ontario west to Manitoba, south to Oklahoma and northern Arkansas, and east to Indiana.
Nations: CA, US
States/Provinces: AR, DC?, IA, IL, IN, KS:S1S2, MB:S4?, MI, MN, MO, ND:S3, NE, NM, OH, OK, ON, PA, QC, SD, SK, WI:S4, WY
TNC Ecoregions: 26:C, 33:C, 34:C, 35:C, 36:C, 37:C, 38:C, 42:?, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:C
USFS Ecoregions (1994/95): 212Hb:CC?, 212Hm:CCC, 212Hs:CCC, 212Hv:CCC, 212Ib:C??, 212Ja:CCP, 212Jb:CC?, 212Jc:CCP, 212Jd:CCC, 212Je:CC?, 212Jf:CC?, 212Jj:CC?, 212Jk:CC?, 212Jl:CC?, 212Jm:CC?, 212Ka:CP?, 212Kb:CPP, 212La:CPP, 212Lb:CPP, 212Lc:CPP, 212Ld:CPP, 212Ma:CPP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 212Nd:CPP, 221Ea:CCC, 221Ec:CCC, 221Ed:CCP, 221Ef:CCC, 221Fa:CCC, 221He:CCC, 222Ak:CC?, 222An:CCC, 222Ao:CCP, 222Db:CCC, 222Ga:CCC, 222Gb:CCC, 222Ha:CCC, 222Hc:CCC, 222Hf:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 222Kg:CCC, 222Md:CCC, 222Na:CPP, 251Aa:CP?, 251Cc:CCC, 251Cd:CC?, 251Cf:CCC, 251Cj:CCC, 251Co:CCC, 251Dg:CCC, 332E:PP
Federal Lands: NPS (Buffalo River, C&O Canal, Effigy Mounds, Indiana Dunes, Isle Royale, National Capital-East, Prince William, Saint Croix); USFS (Chequamegon-Nicolet?, Chequamegon?, Chippewa?, Nicolet?, Ottawa?, Wayne); USFWS (Erie)

ELEMENT SOURCES

Local Description Authors: M. Pyne
Global Description Authors: D. Faber-Langendoen
References: Baalman 1965, Chapman et al. 1989, Eggers and Reed 1987, Faber-Langendoen 2001, Greenall 1996, Hoagland 1997, Hoagland 2000, Hop et al. 2005, Hop et al. 2009, INAI unpubl. data, Kartesz 1999, Lauver et al. 1999, Lee et al. 1998, MNNHP 1993, Midwestern Ecology Working Group n.d., NDNHI unpubl. data, Nelson 1985, Shaw and Fredine 1971, Steinauer and Rolfsmeier 1997, Steinauer and Rolfsmeier 2000, Steinauer and Rolfsmeier 2003, TNC 1999b, WNHIP unpubl. data

Southern Cattail Marsh

***Typha latifolia* Southern Herbaceous Vegetation**
Broadleaf Cattail Southern Herbaceous Vegetation
Identifier: CEGL004150

NVC CLASSIFICATION

Division Eastern North American Freshwater Wet Meadow, Riparian & Marsh (2.B.6.Na)

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Macrogroup	Eastern North American Wet Meadow & Marsh (M069)
Group	Eastern North American Freshwater Marsh (G125)
Association (Common name)	Southern Cattail Marsh

ELEMENT CONCEPT

Global Summary: This association is a semi-natural type, consisting of *Typha latifolia* (broadleaf cattail) as an essentially monospecific stand, especially in artificial wetlands, such as borrow pits or ponds. The water table is at or above the soil surface for at least part of the growing season. The dominant species, *Typha latifolia* (broadleaf cattail), often forms dense, almost monotypic stands. *Carex* (sedge) spp. and *Schoenoplectus* (bulrush) spp. are often found in this community, especially on the margins. Other co-occurring species of this association are not fully understood. It is a widespread type. In the Interior Low Plateau of Tennessee, *Typha latifolia* (broadleaf cattail) is commonly found with *Scirpus cyperinus* (woolgrass) in roadside ditches and on the margins of ponds and reservoirs.

ENVIRONMENTAL DESCRIPTION

Global Environment: This type is found especially in artificial wetlands, such as borrow pits or ponds. The water table is at or above the soil surface for at least part of the growing season.

VEGETATION DESCRIPTION

Global Vegetation: Stands of this association consist of *Typha latifolia* (broadleaf cattail) as an essentially monospecific stand. *Carex* (sedge) spp. and *Schoenoplectus* (bulrush) spp. are often found in this community, especially on the margins. Other co-occurring species of this association are not fully understood. In the Interior Low Plateau of Tennessee, *Typha latifolia* (broadleaf cattail) is commonly found with *Scirpus cyperinus* (woolgrass). In addition, *Juncus effusus* (common rush) and an occasional *Alnus serrulata* (hazel alder) are also present.

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (14-Jun-2001). This is a wide-ranging type that includes naturally occurring and artificial wetlands.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: This community is a common element found in many Southeastern wetland systems, but little work has been done to determine its diagnostic features and component species. The variability of this association across its range and its relation to adjacent types in this and related alliances are not fully understood. At Arnold Air Force Base, Coffee and Franklin counties, Tennessee, this vegetation is found scattered along the border of Woods Reservoir. It appears to be a component of a mosaic of communities which form bands from the edge of the reservoir to the surrounding forest. The band found at the reservoir's edge is dominated by *Typha latifolia* (broadleaf cattail) and *Scirpus cyperinus* (woolgrass). *Juncus* (rush) sp., grasses, and an occasional *Alnus serrulata* (hazel alder) are also present. The *Typha latifolia* (broadleaf cattail) grows patchily, being concentrated in dense clumps throughout the outer band.
Global Similar Associations:
Scirpus cyperinus Seasonally Flooded Southern Herbaceous Vegetation (CEGL003866)
Typha (angustifolia, domingensis, latifolia) - *Schoenoplectus americanus* Herbaceous Vegetation (CEGL002032)
Typha (angustifolia, latifolia) - *(Schoenoplectus* spp.) Eastern Herbaceous Vegetation (CEGL006153)
Typha (latifolia, angustifolia) Western Herbaceous Vegetation (CEGL002010)
Typha spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229)
Typha spp. Great Plains Herbaceous Vegetation (CEGL002389)
Global Related Concepts:
IID6a. Natural Impoundment Pond (Allard 1990) **>**
L5D2aI2a. *Typha latifolia* (Foti et al. 1994) **?**
P5A4bII2a. *Typha latifolia* (Foti et al. 1994) **?**

ELEMENT DISTRIBUTION

Global Range: This vegetation is possible throughout the southeastern United States.
Nations: US
States/Provinces: AL, AR, FL?, GA, KY, LA, MS, NC, OK, SC, TN, TX, VA, WV
TNC Ecoregions: 31:C, 38:C, 39:C, 41:C, 42:C, 43:C, 44:C, 50:P, 52:?, 53:P, 56:C, 57:P, 59:C
USFS Ecoregions (1994/95): 221:C, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Cf:CCP, 222Cg:CCP, 222Eb:CCC, 222Eg:CCP, 222Eh:CCP, 231A:C?, 231Fb:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Ce:CCC, 234Aa:CCC, 234Ac:CCC, 234Ad:CCC, 234Af:CCC, 234Ag:CCC, 234Ai:CCC, 234Al:CCC, 234Am:CCC, 234An:CCC, 251:P, 255Da:CCC, 255Dc:CCC, M221:C, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC
Federal Lands: DOD (Arnold, Fort Benning); NPS (Buffalo River, Chickamauga-Chattanooga?, Chickasaw NRA, Cumberland Island, Mammoth Cave, Ninety Six); USFS (Daniel Boone?, Kisatchie, Oconee?, Ouachita, Ouachita (Mountains), Ozark, Talladega (Oakmulgee)?, Talladega (Talladega)?, Talladega?, Tuskegee?); USFWS (Anahuac, Brazoria, Reelfoot, San Bernard)

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ELEMENT SOURCES

Local Description Authors:
Global Description Authors: L.M. Smith, A.S. Weakley and J.E. Mohan, mod. K.D. Patterson
References: Allard 1990, Blair and Hubbell 1938, Foti 1994b, Foti et al. 1994, Grace and Wetzel 1981, Hoagland 2000, McCoy 1958, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, TNC 1998a

5. AQUATIC VEGETATION

5.B.1. Freshwater Aquatic Vegetation

5.B.1.Na. North American Freshwater Aquatic Vegetation

M108. Eastern North American Freshwater Aquatic Vegetation

G114. Eastern North American Freshwater Aquatic Vegetation

Watershield Pond

***Brasenia schreberi* Eastern Herbaceous Vegetation**
Watershield Eastern Herbaceous Vegetation
Identifier: CEGL004527

NVC CLASSIFICATION

Division	North American Freshwater Aquatic Vegetation (5.B.1.Na)
Macrogroup	Eastern North American Freshwater Aquatic Vegetation (M108)
Group	Eastern North American Freshwater Aquatic Vegetation (G114)
Association (Common name)	Watershield Pond

ELEMENT CONCEPT

Global Summary: This vegetation occurs in a range of natural ponds and impoundments, including ponds, beaver ponds, and lake margins. *Brasenia schreberi* (watershield) is the dominant plant species; other species may include *Leersia oryzoides* (rice cutgrass), *Lemna valdiviana* (valdivia duckweed), *Juncus effusus* (common rush), *Stuckenia pectinata* (sago pondweed), *Nymphaea odorata* (American white waterlily), and *Spirodela polyrrhiza* (common duckmeat). An occurrence along the Texas coast at McFaddin National Wildlife Refuge occupies the "open water" areas interspersed with emergent vegetation and "flotant" marsh dominated by *Panicum hemitomon* (maidencane) (*Panicum hemitomon* (maidencane) Semipermanently Flooded Herbaceous Vegetation (CEGL004665)). Other floating aquatics present include *Nelumbo lutea* (American lotus), *Nymphaea odorata* (American white waterlily), *Nymphaea mexicana* (yellow waterlily), and *Utricularia* (bladderwort) spp., along with submersed aquatics such as *Cabomba caroliniana* (Carolina fanwort) and *Ceratophyllum demersum* (coon's-tail) and rooted aquatics such as *Pontederia cordata* (pickerelweed) and *Zizaniopsis miliacea* (giant cutgrass). Additional information is needed on the full range and variability of expression of this vegetation.

ENVIRONMENTAL DESCRIPTION

Global Environment: This vegetation occurs in a range of natural ponds and impoundments, including ponds, beaver ponds, and lake margins.

VEGETATION DESCRIPTION

Global Vegetation: *Brasenia schreberi* (watershield), a floating aquatic native to Florida that has become naturalized throughout much of the eastern and western U.S. and Canada, is the dominant plant species; other species may include *Leersia oryzoides* (rice cutgrass), *Lemna valdiviana* (valdivia duckweed), *Juncus effusus* (common rush), *Stuckenia pectinata* (sago pondweed), *Nymphaea odorata* (American white waterlily), and *Spirodela polyrrhiza* (common duckmeat). Other floating aquatics present include *Nelumbo lutea* (American lotus), *Nymphaea odorata* (American white waterlily), *Nymphaea mexicana* (yellow waterlily), and *Utricularia* (bladderwort) spp., along with submersed aquatics such as *Cabomba caroliniana* (Carolina fanwort) and *Ceratophyllum demersum* (coon's-tail) and rooted aquatics such as *Pontederia cordata* (pickerelweed) and *Zizaniopsis miliacea* (giant cutgrass).

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (19-Sep-2001). This open water vegetation with floating leaves occurs in lakes, ponds, and slow streams. Its habitat may be vulnerable to invasion by non-native aquatic plant species such as water hyacinth (*Eichhornia crassipes* (common water hyacinth)).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate

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Global Comments: Known from artificial impoundments on the Ozark National Forest (Bayou District). An apparently disjunct example from the Interior Low Plateau is known from Kentucky's "Hundred Acre Pond," a Karst sinkhole wetland. *Brasenia schreberi* (watershield) is the dominant floating aquatic in the "open water" areas of Willow Slough Marsh (approx. 1000 acres) at McFaddin National Wildlife Refuge, Texas. Reported from South Carolina by Aulbach-Smith (pers. comm. 2001).

Global Similar Associations:
Brasenia schreberi Western Herbaceous Vegetation (CEGL005200)
Ceratophyllum demersum - Stuckenia pectinata Herbaceous Vegetation (CEGL004528)

Global Related Concepts:
Brasenia schreberi Association (Christy 2004) =
Open Water/Aquatic Bed Veg., Natural Impoundment Pond (Ambrose 1990a) >
Submergent/Floating Vascular Vegetation (Smith 1996a) >

ELEMENT DISTRIBUTION

Global Range: This community is found throughout the southeastern United States, from Georgia to Texas and in the interior to Kentucky, Oklahoma, and Arkansas.
Nations: CA, US
States/Provinces: AL, AR, FL, GA, KY, LA, MS, OK, QC:S4?, SC, TX
TNC Ecoregions: 31:C, 38:C, 39:?, 40:C, 41:C, 42:P, 43:C, 44:C, 52:C, 53:C, 55:C, 56:C
USFS Ecoregions (1994/95): 231A:C?, 231B:CP, 231E:CP, 231Fb:CCC, 232B:CC, 232C:CP, 232D:CP, 232E:CP, 232F:CP, 232Gb:CCC, 255D:PP, M222Ab:CCC
Federal Lands: DOD (Fort Benning, Fort Gordon); NPS (Big South Fork, Buffalo River, Canaveral); USFS (Angelina, Davy Crockett, Ozark); USFWS (McFaddin)

ELEMENT SOURCES

Local Description Authors:
Global Description Authors: B. Hoagland
References: Ambrose 1990a, Aulbach-Smith pers. comm., Christy 2004, Hoagland 1997, Hoagland 2000, Kagan et al. 2004, Kunze 1994, Schotz pers. comm., Smith 1996a, Southeastern Ecology Working Group n.d., Titus unpubl. data 1996, WNHP unpubl. data

Water-willow Rocky Bar and Shore

***Justicia americana* Herbaceous Vegetation**
American Water-willow Herbaceous Vegetation
Identifier: CEGL004286

NVC CLASSIFICATION

Division	North American Freshwater Aquatic Vegetation (5.B.1.Na)
Macrogroup	Eastern North American Freshwater Aquatic Vegetation (M108)
Group	Eastern North American Freshwater Aquatic Vegetation (G114)
Association (Common name)	Water-willow Rocky Bar and Shore

ELEMENT CONCEPT

Global Summary: This association is found primarily in the Piedmont, Central Appalachians, Cumberland Plateau, Interior Low Plateau, Ozarks, Ouachita Mountains, and adjacent provinces. Stands occur on the shoals or bars of rocky streams and riverbeds, where they are subject to frequent high-energy floods. Slopes range from level to moderate but are typically gentle. The substrate is a variable mixture of sand, gravel and cobbles, often with deposits of silt and muck. Rooting occurs in the interstices between cobbles and boulders. *Justicia americana* (American water-willow) is the characteristic dominant. *Saururus cernuus* (lizard's-tail) is often present and may be codominant. Other herbaceous species that may be present include *Bidens* (beggarticks) spp., *Cyperus* (flatsedge) spp., *Diodia teres* (poorjoe), *Elodea* (waterweed) sp., *Eleocharis* (spikerush) spp., *Equisetum arvense* (field horsetail), *Gratiola brevifolia* (sticky hedgehyssop), *Leersia oryzoides* (rice cutgrass), *Leersia virginica* (whitegrass), *Lemna minor* (common duckweed), *Orontium aquaticum* (goldenclub), *Physostegia virginiana* (obedient plant), *Podostemum ceratophyllum* (hornleaf riverweed), *Polygonum caespitosum var. longisetum* (oriental ladysthumb), *Scirpus* (bulrush) spp., *Schoenoplectus pungens* (common threesquare), *Schoenoplectus tabernaemontani* (softstem bulrush), and *Xyris difformis var. difformis* (bog yelloweyed grass). Exotics include *Lythrum salicaria* (purple loosestrife) and *Lysimachia vulgaris* (garden yellow loosestrife); where present, these are sparse. Some stands have low cover by scattered flood-suppressed trees or an overhanging canopy. Trees in plots include *Acer saccharinum* (silver maple), *Betula nigra* (river birch), *Carpinus caroliniana* (American hornbeam), *Fraxinus pennsylvanica* (green ash), and *Platanus occidentalis* (American sycamore). Scattered shrub seedlings of *Salix nigra* (black willow), *Salix caroliniana* (coastal plain willow), *Betula nigra* (river birch), *Cephalanthus occidentalis* (common buttonbush), *Acer saccharinum* (silver maple), or *Platanus occidentalis* (American sycamore) may also be present. This association provides habitat in some portions of its range for globally rare dragonflies and herbs.

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ENVIRONMENTAL DESCRIPTION

Global Environment: This association occurs on the shoals or bars of rocky streams and riverbeds, on bedrock, boulders, cobble, gravel, and sands. They are subject to frequent high-energy floods, and are entirely submerged by most flood events. During extreme low water periods, the substrate can be exposed, showing a varied mixture of sand, gravel and cobbles, often with deposits of silt and muck. Rooting occurs in the interstices between cobbles and boulders. Stands commonly occur on the edge of the river and at the heads and tails of islands and may sometimes occur on deposition bars in the middle of the river. Substrate pH is circumneutral (mean = 6.0) in four samples. Slopes range from level to moderate but are typically gentle. Elevations of West Virginia stands range from 73 to at least 654 m; the type occurs at lower elevations in the Piedmont and Coastal Plain.

VEGETATION DESCRIPTION

Global Vegetation: *Justicia americana* (American water-willow) is the dominant (and sometimes the only) species, forming lawnlike stands in shallow reaches of rivers. Cover by *Justicia americana* (American water-willow) ranges from 40 to 85%. *Saururus cernuus* (lizard's-tail) is often present and may be codominant. Other herbaceous species may be present but rarely achieve more than 2% cover; they include *Bidens* (beggarticks) spp., *Cyperus* (flatsedge) spp., *Diodia teres* (poorjoe), *Elodea* (waterweed) sp., *Eleocharis* (spikerush) spp., *Equisetum arvense* (field horsetail), *Gratiola brevifolia* (sticky hedgehyssop), *Leersia oryzoides* (rice cutgrass), *Leersia virginica* (whitegrass), *Lemna minor* (common duckweed), *Orontium aquaticum* (goldenclub), *Physostegia virginiana* (obedient plant), *Podostemum ceratophyllum* (hornleaf riverweed), *Polygonum caespitosum var. longisetum* (oriental ladysthumb), *Scirpus* (bulrush) spp., *Schoenoplectus pungens* (common threesquare), *Schoenoplectus tabernaemontani* (softstem bulrush), and *Xyris difformis var. difformis* (bog yelloweyed grass). Exotics include *Lythrum salicaria* (purple loosestrife) and *Lysimachia vulgaris* (garden yellow loosestrife); they have not been observed in abundance in this community, possibly due to intolerance of high-energy flooding. In some areas, *Justicia* (water-willow) usually grows in nearly pure patches, so that few other species are associated with it. *Cuscuta gronovii* (scaldweed), *Mimulus ringens* (Allegheny monkeyflower), *Polygonum* (knotweed) spp., *Rumex* (dock) spp., and *Salix interior* (sandbar willow) can also occur (Anderson 1982). Some stands have low cover by scattered flood-suppressed trees or an overhanging canopy. Trees in plots include *Acer saccharinum* (silver maple), *Betula nigra* (river birch), *Carpinus caroliniana* (American hornbeam), *Fraxinus pennsylvanica* (green ash), and *Platanus occidentalis* (American sycamore). Scattered shrub seedlings of *Salix nigra* (black willow), *Salix caroliniana* (coastal plain willow), *Betula nigra* (river birch), *Cephalanthus occidentalis* (common buttonbush), *Acer saccharinum* (silver maple), or *Platanus occidentalis* (American sycamore) may also be present. In the Cumberland Plateau of Alabama, *Justicia americana* (American water-willow) is present in dense patches with some interspersion of other species, including *Pilea pumila* (Canadian clearweed), *Boehmeria cylindrica* (small-spike false nettle), *Eclipta prostrata* (false daisy), *Juncus coriaceus* (leathery rush), *Mikania scandens* (climbing hempvine), *Ludwigia palustris* (marsh seedbox), *Leersia* (cutgrass) sp., and *Bidens* (beggarticks) sp. Schmalzer and DeSelm (1982) discuss *Orontium aquaticum* (goldenclub) growing along streambanks or in shallow riffles "along or with" *Justicia americana* (American water-willow) in the Obed River in the Cumberland Plateau of Tennessee. In 29 plots sampled in the Potomac River watershed (Piedmont, Blue Ridge and Ridge and Valley provinces), *Justicia* (water-willow) was overwhelmingly dominant (50-75% mean cover), and no associated species occurred in more than 48% of the plots. Vascular plant species richness in sampled plots is low (typically 6-14 taxa).

MOST ABUNDANT SPECIES

Global

Stratum	Lifeform	Species
Herb (field)	Forb	*Justicia americana* (American water-willow)

CHARACTERISTIC SPECIES

Global: *Justicia americana* (American water-willow), *Leersia oryzoides* (rice cutgrass), *Leersia virginica* (whitegrass), *Orontium aquaticum* (goldenclub), *Polygonum amphibium* (water knotweed), *Polygonum caespitosum* var. *longisetum* (oriental ladysthumb), *Saururus cernuus* (lizard's-tail), *Schoenoplectus pungens* (common threesquare)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (12-Sep-1997).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Global Comments: This type, in Ohio, often forms pure patches, but consistent identification may require a simple cutoff rule, such as at least 50% cover of *Justicia* (water-willow) (Anderson 1982). However, Anderson (1996) no longer recognizes this type.
Global Similar Associations:
Hymenocallis coronaria - *Justicia americana* Herbaceous Vegetation (CEGL004285)
Justicia americana - *Peltandra virginica* Herbaceous Vegetation [Provisional] (CEGL006579) occurs in freshwater tidal habitats.
Peltandra virginica - *Saururus cernuus* - *Boehmeria cylindrica* / *Climacium americanum* Herbaceous Vegetation (CEGL007696)
Global Related Concepts:
Justicia americana - *Andropogon gerardii* herbaceous channel bed (Walton and Anderson 1997) =
Justicia americana Herbaceous Vegetation (Harrison 2004) =
Justicia americana riparian herbaceous vegetation (Vanderhorst 2001b) =

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Aquatic Types (Schmalzer and DeSelm 1982) >
Depositional Bars and Shore (Harrison 2004) >
IIE3a. Riverside Shoal and Stream Bar Complex (Allard 1990) >
Lizard's tail emergent bed (Perles et al. 2004) **?**
Rocky Bar / Shore (Fleming et al. 2001) >
Rocky Bar and Shore (Schafale and Weakley 1990) >
Rocky Bar and Shore (Water Willow Subtype) (Schafale 1998b) **?**
Rocky Bar and Shore (Water Willow Subtype) (Schafale 2002) =
Water willow emergent bed (Perles et al. 2004) **?**

ELEMENT DISTRIBUTION

Global Range: This type is found primarily in the Piedmont, Interior Low Plateau, Cumberland Plateau, Ozarks, Ouachita Mountains, Central Appalachians, and adjacent provinces. It ranges from Alabama, Georgia and the Carolinas west to Arkansas and Oklahoma and north to Ohio, New York, and New Jersey, with possible outliers north to southern Quebec.
Nations: CA, US
States/Provinces: AL, AR, GA, KY, MD:S5, NC, NJ, NY, OH:S4, OK, PA, QC:S1?, SC?, TN, VA:S4, WV
TNC Ecoregions: 38:C, 39:C, 43:C, 44:C, 45:C, 48:C, 49:C, 50:C, 51:C, 52:C, 59:C, 60:C, 61:C
USFS Ecoregions (1994/95): 212Fa:CCP, 212Fb:CCC, 212Fc:CCC, 212Ga:CCP, 212Gb:CCP, 221Am:CCP, 221Ba:CCC, 221Bd:CCC, 221Da:CCC, 221Db:CCC, 221Ea:CCP, 221Ec:CCC, 221Ed:CCP, 221Ef:CCP, 221Ha:CCC, 221Hc:CCC, 221He:CCC, 222Dg:CCC, 222Eb:CCC, 222Eg:CCC, 222Ej:CCP, 222En:CCC, 222Eo:CCC, 222Ha:CCC, 231Af:CCC, 231B:CC, 231Cc:CCC, 231Cd:CCC, 231D:CC, M221Aa:CCC, M221Ac:CCC, M221Ad:CCC, M221Bb:CCC, M221Bd:CCC, M221Be:CCC, M221Bf:CCC, M221Ca:CCC, M221Cb:CCC, M221Cd:CCC, M221Da:CCC, M221Dc:CCC, M222A:CC, M231A:CC
Federal Lands: NPS (Appalachian Trail (Central Appalachians), Appalachian Trail (Lower New England & Northern Appalachians), Big South Fork, Buffalo River, C&O Canal, Chickasaw NRA, Delaware Water Gap, Gauley River, George Washington Parkway, Harpers Ferry, Little River Canyon, Mammoth Cave, Manassas, Natchez Trace, New River Gorge, Obed River, Stones River, Upper Delaware); USFS (Bankhead, Cherokee, Daniel Boone, Nantahala, Oconee?, Ouachita, Ouachita (Mountains), Ozark, Pisgah, Sumter (Mountains)?, Sumter (Piedmont)?, Sumter?, Uwharrie, Wayne)

ELEMENT SOURCES

Local Description Authors:
Global Description Authors: A.S. Weakley, mod. D. Faber-Langendoen and S.C. Gawler
References: Allard 1990, Anderson 1982, Anderson 1996, Fike 1999, Fleming 2007, Fleming and Patterson 2011a, Fleming and Taverna 2006, Fleming et al. 2001, Harrison 2004, Hoagland 1997, Hoagland 2000, Lea 2000, Lea 2004, Major et al. 1999, McCoy 1958, Nelson 1986, Nordman 2004, ONHD unpubl. data, Palmer-Ball et al. 1988, Peet et al. unpubl. data, Penfound 1953, Perles et al. 2004, Perles et al. 2007, Perles et al. 2008, Schafale 1998b, Schafale 2002, Schafale 2011, Schafale and Weakley 1990, Schmalzer and DeSelm 1982, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, TNC and WPC 2004, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2010, Walton and Anderson 1997

6. ROCK VEGETATION

6.B.2. Temperate & Boreal Cliff, Scree & Rock Vegetation

6.B.2.Na. Eastern North American Temperate Cliff, Scree & Rock Vegetation

M111. Eastern North American Cliff & Rock Vegetation

G340. Eastern North American Talus & Bluff

Midwest Limestone - Dolostone Talus

Limestone - Dolostone Talus Sparse Vegetation
Limestone - Dolostone Talus Sparse Vegetation
Identifier: CEGL002308

NVC CLASSIFICATION

Division	Eastern North American Temperate Cliff, Scree & Rock Vegetation (6.B.2.Na)
Macrogroup	Eastern North American Cliff & Rock Vegetation (M111)
Group	Eastern North American Talus & Bluff (G340)
Association (Common name)	Midwest Limestone - Dolostone Talus

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ELEMENT CONCEPT

Global Summary: This limestone-dolostone talus community is found throughout the central/upper midwestern United States, including the Ozark region, and adjacent Canada. Stands occur at the bases of steep cliffs along larger streams or rivers, or strongly dissected valleys. Aspect is variable, and moisture could be moist or dry. Soils are generally absent. Parent material could be limestone or dolostone with a mixture of rock fragments and large boulders. The vegetation is generally sparse but may vary depending on degree of slope, exposure (open versus shaded), and rock type. The composition of the type may be heavily influenced by adjacent forested stands. In Missouri, characteristic species include the ferns *Adiantum pedatum* (northern maidenhair), *Diplazium pycnocarpon* (glade fern), *Asplenium rhizophyllum* (walking fern), and *Cystopteris bulbifera* (bulblet bladderfern). Other herbaceous species include *Aralia nudicaulis* (wild sarsaparilla), *Impatiens capensis* (jewelweed), *Pilea pumila* (Canadian clearweed), *Polymnia canadensis* (whiteflower leafcup), and *Physalis missouriensis* (Missouri groundcherry). Scattered woody plants include *Hydrangea arborescens* (wild hydrangea) and *Staphylea trifolia* (American bladdernut). In Ontario open talus stands contain *Adiantum pedatum* (northern maidenhair), *Ageratina altissima* (white snakeroot), *Geranium robertianum* (Robert's geranium), *Impatiens capensis* (jewelweed), *Poa pratensis* (Kentucky bluegrass), and *Toxicodendron radicans* (eastern poison-ivy).

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.

Global Environment: Stands occur at the bases of steep cliffs along larger streams or rivers, or strongly dissected valleys. Aspect is variable, and moisture could be moist or dry. Soils are generally absent. Parent material could be limestone or dolostone with a mixture of rock fragments and large boulders. The vegetation is generally sparse, but may vary depending on degree of slope, exposure (open versus shaded) and rock type (Nelson 1985).

VEGETATION DESCRIPTION

Buffalo National River Vegetation: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.

Global Vegetation: The vegetation is generally sparse, but may vary depending on degree of slope, exposure (open versus shaded) and rock type. The composition of the type may be heavily influenced by adjacent forested stands. In Missouri, characteristic species include the ferns *Adiantum pedatum* (northern maidenhair), *Diplazium pycnocarpon* (glade fern), *Asplenium rhizophyllum* (walking fern), and *Cystopteris bulbifera* (bulblet bladderfern). Other herbaceous species include *Aralia nudicaulis* (wild sarsaparilla), *Impatiens capensis* (jewelweed), *Pilea pumila* (Canadian clearweed), *Polymnia canadensis* (whiteflower leafcup), and *Physalis missouriensis* (Missouri groundcherry). Scattered woody plants include *Hydrangea arborescens* (wild hydrangea) and *Staphylea trifolia* (American bladdernut) (Nelson 1985). In Ontario open talus stands contain *Adiantum pedatum* (northern maidenhair), *Ageratina altissima* (white snakeroot), *Geranium robertianum* (Robert's geranium), *Impatiens capensis* (jewelweed), *Poa pratensis* (Kentucky bluegrass), and *Toxicodendron radicans* (eastern poison-ivy) (Lee et al. 1998).

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (3-Mar-2000). Many sites may not lack proper buffers along the clifftops or lower slopes.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Buffalo National River Comments: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.

Global Comments: This type has not been described across its range, with the exception of Missouri (Nelson 1985) and somewhat in Ontario (Lee et al. 1998). Further study is needed to characterize the type. It may be very localized. Rare snails may also be found. The type is especially notable at the base of limestone and dolostone cliffs of the Niagara Escarpment, e.g. in eastern Wisconsin on the Door Peninsula (E. Epstein pers. comm. 1999).

Global Similar Associations:

Sandstone Interior Highlands Talus Sparse Vegetation (CEGL002309)
Sandstone Talus Northern Sparse Vegetation (CEGL005202)
Thuja occidentalis Carbonate Talus Woodland (CEGL005172)

Global Related Concepts:

Dry Non-Acid Cliff (Chapman et al. 1989) >
Limestone Talus (Faber-Langendoen 2001) =
Talus Slope (MNNHP 1993) >

ELEMENT DISTRIBUTION

Buffalo National River Range: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.

Global Range: This limestone-dolostone talus community is found throughout the central/upper midwestern United States, including the Ozark region, and adjacent Canada, extending from Ontario west to Minnesota, south to Arkansas, and east to possibly Illinois.

Nations: CA, US

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States/Provinces: AR, IA:S5, IL, MI, MN, MO:S4, ON, QC, VT, WI:S2
TNC Ecoregions: 36:C, 38:C, 46:C, 48:C, 64:C
USFS Ecoregions (1994/95): 222Ac:CCC, 222Ae:CCC, 222Ag:CCC, 222Lc:CCC, 222Lf:CCC, 251Ce:CCC, 251Ch:CCC
Federal Lands: NPS (Buffalo River?, Ozark Riverways); USFS (Ozark?)

ELEMENT SOURCES

Buffalo National River Plots: None.
Local Description Authors: H. Summer
Global Description Authors: D. Faber-Langendoen
References: Chapman et al. 1989, Chastain et al. 2006, Faber-Langendoen 2001, INAI unpubl. data, Lee et al. 1998, MNNHP 1993, Midwestern Ecology Working Group n.d., Nelson 1985, WNHIP unpubl. data

Interior Highlands Sandstone Talus

Sandstone Interior Highlands Talus Sparse Vegetation
Sandstone Interior Highlands Talus Sparse Vegetation
Identifier: CEGL002309

NVC CLASSIFICATION

Division	Eastern North American Temperate Cliff, Scree & Rock Vegetation (6.B.2.Na)
Macrogroup	Eastern North American Cliff & Rock Vegetation (M111)
Group	Eastern North American Talus & Bluff (G340)
Association (Common name)	Interior Highlands Sandstone Talus

ELEMENT CONCEPT

Global Summary: This sandstone talus community is found in the Ozark and Ouachita regions of the United States. Stands occur at the bases of steep cliffs along larger streams or rivers, or strongly dissected valleys. Aspect is variable, and they can be relatively moist or relatively dry. Soils are generally absent. Parent material is sandstone with a mixture of rock fragments and large boulders. The vegetation is generally sparse but may vary depending on degree of slope, exposure (open versus shaded) and rock type. The composition of the type may be heavily influenced by adjacent forested stands. Vascular plants are generally very sparse, absent, or limited to marginal areas. Vines and viney shrubs are characteristic of this community (at least its margins), because their habit allows them to exploit the combination of abundant available light and scarce rooting opportunities. Characteristic vines and shrubs can include *Ribes* (currant) spp., *Toxicodendron radicans* (eastern poison-ivy), *Parthenocissus quinquefolia* (Virginia creeper), and *Philadelphus pubescens* (hoary mock orange). Characteristic herbaceous species can include the annual composite *Polymnia canadensis* (whiteflower leafcup) and the ferns *Dryopteris marginalis* (marginal woodfern) and *Polypodium virginianum* (rock polypody). *Sassafras albidum* (sassafras) seems to be a particularly characteristic tree species of the margins of this community; *Cornus alternifolia* (alternateleaf dogwood) is also reported from Missouri occurrences. Foliose, crustose, and umbilicate lichens are common.

ENVIRONMENTAL DESCRIPTION

Buffalo National River Environment: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.
Global Environment: Stands occur at the bases of steep cliffs along larger streams or rivers, or strongly dissected valleys. Aspect is variable, and they can be relatively moist or relatively dry. Soils are generally absent. Parent material is sandstone with a mixture of rock fragments and large boulders (Nelson 1985).

VEGETATION DESCRIPTION

Buffalo National River Vegetation: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.
Global Vegetation: The vegetation is generally sparse but may vary depending on degree of slope, exposure (open versus shaded) and rock type. The composition of the type may be heavily influenced by adjacent forested stands. Vascular plants are generally very sparse, absent, or limited to marginal areas. Vines and viney shrubs are characteristic of this community (at least its margins), because their habit allows them to exploit the combination of abundant available light and scarce rooting opportunities. Characteristic vines and shrubs can include *Ribes* (currant) spp., *Toxicodendron radicans* (eastern poison-ivy), *Parthenocissus quinquefolia* (Virginia creeper), and *Philadelphus pubescens* (hoary mock orange). Characteristic herbaceous species can include the annual composite *Polymnia canadensis* (whiteflower leafcup) and the ferns *Dryopteris marginalis* (marginal woodfern) and *Polypodium virginianum* (rock polypody). *Sassafras albidum* (sassafras) seems to be a particularly characteristic tree species of the margins of this community; *Cornus alternifolia* (alternateleaf dogwood) is also reported from Missouri occurrences. Foliose, crustose, and umbilicate lichens are common. (Nelson 1985, M. Pyne pers. comm. 1998)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (3-Oct-1996).

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CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Buffalo National River Comments: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.
Global Comments: The concept of the type is taken from the Missouri state type - sandstone talus (Nelson 1985); however, Missouri sandstone talus is so uncommon and small that the type may be dropped (M. Leahy pers. comm. 2000). Occurrences at relatively high elevations and in more mountainous terrain of the Ozarks and Ouachitas should be further assessed for their similarity to Missouri Ozarks stands. In Arkansas excellent examples of the blocky sandstone type occur at Mount Magazine State Park and along Talamena Drive, near the Oklahoma border. The possible occurrence of this community in the Interior Low Plateau should be checked. Related vegetation with substantial tree cover and better soil development (such as mesic sandstone forests) is classified elsewhere.
Global Similar Associations:
Igneous Ozark Talus Sparse Vegetation (CEGL005203)
Limestone - Dolostone Talus Sparse Vegetation (CEGL002308)
Global Related Concepts:
Sandstone Talus (Nelson 1985) =

ELEMENT DISTRIBUTION

Buffalo National River Range: This association was not documented at Buffalo River as part of this project, although it is possible that it does occur at the park.
Global Range: This sandstone talus community is found in the Ozark and Ouachita regions of the United States, particularly in Arkansas, Oklahoma and Missouri.
Nations: US
States/Provinces: AR, MO:S4S5, OK
TNC Ecoregions: 38:C, 39:C
USFS Ecoregions (1994/95): 222Ac:CCC
Federal Lands: NPS (Buffalo River?); USFS (Ouachita, Ouachita (Mountains), Ozark)

ELEMENT SOURCES

Buffalo National River Plots: None.
Local Description Authors: H. Summer
Global Description Authors: D. Faber-Langendoen
References: Leahy pers. comm., Midwestern Ecology Working Group n.d., Nelson 1985, Pyne pers. comm.

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Appendix C: Field Key to Vegetation Types

Key to Vegetation Types at the Buffalo National River

Key Structure:

This key covers natural and semi-natural communities that have local and global descriptions consistent with the National Vegetation Classification Standard (NVCS), Version 2 (FGDC 2008). Cultural and significantly altered community types are not necessarily fully described by the NVCS. However, some community types that are represented in this key exhibit some characteristics of both natural and cultural types, or they are clearly in the process of succession to a natural type; thus they are included.

The key follows the structure of the NVCS hierarchy through the initial levels:

I. Physiognomic structure, based on the typical degree of canopy closure, stature, and life form of the dominant species, then
   A. Woody leaf phenology, if the community is a forest, woodland or shrubland, then
   B. Habitat and/or substrate type

A quick reference key for the initial physiognomic groups presented above begins on page 2. This key allows one to quickly access the appropriate group of vegetation associations based on physiognomic class and leaf phenology, and habitat or growing substrate.

Beyond these divisions, communities are generally grouped together so that closely related associations will be found near one another in the key. However, there are often splits of groups based on moisture or substrate relationships that may lead to final groups including associations within two or more alliances within the NVCS.

THIS KEY IS NOT NECESSARILY DICHOTOMOUS. In some sections, there are many choices. USERS SHOULD READ ALL OPTIONS WITHIN THE SAME HIERARCHICAL LEVEL BEFORE PROCEEDING IN THE KEY.

Unless otherwise stated, "dominant" means > 50% relative canopy cover. Co-dominant means several species aggregate to >50 % relative cover.

In the descriptive criteria of the NVCS, "woodlands" may have between 25% and 60% closure of the canopy and subcanopy (treed strata) combined. This is subject to some interpretation, as a "woodland" can be, in effect, "overstocked" - or conversely a "forest" may have been thinned as through effects of an ice storm.

Key Results:

Successful use of this key will yield two pieces of information: 1) a four digit code and 2) a community name. The four digit code corresponds to the last four digits of the Community Global Element (CEGL) code in the NVCS for a given association. For the Buffalo National River (BUFF) vegetation mapping project, the format of that identifier for all natural and semi-natural associations is "CEGL00####". The community names are the common names in the NVCS that are assigned to the CEGL code. The common names of types that are documented by vegetation sampling plots at the BUFF are in **bold type**. Those that are not documented by plots yet do occur at the BUFF are given in *italic type*.

Quick Key to Major Groups of Communities Based on Physiognomic Class and Leaf Phenology, Habitat or Substrate

NATURAL AND SEMI-NATURAL COMMUNITIES C-5
I. FORESTS—Communities with the uppermost stratum composed of large trees, generally >15 m tall. Canopy cover is greater than 60%, usually with crowns touching or overlapping and little visible sky between crowns. Other than tree-fall gaps, canopy height and cover are fairly uniform, creating more or less complete shade. Tree and shrub layers generally discrete, forming a multi-layered community. C-5
A. Forests with evergreen vegetation providing > 75% of canopy cover C-5
B. Forests with deciduous vegetation providing > 75% of canopy cover C-6
C. Mixed forests with both deciduous and evergreen vegetation providing at least 25% of relative canopy cover C-11
II. WOODLANDS—Communities with 15- 60 % canopy cover composed of either a) widely spaced, large trees with often spreading limbs, a poorly developed shrub layer (except where fire damage has caused resprouting), and vigorous herbaceous growth or, b) stunted trees of varying heights where identification of the canopy may be difficult due to intermingling between trees and a dense shrub layer, and where groundflora can be diverse and of variable cover. In the latter example, timber quality is generally poor C-13
A. Evergreen vegetation providing > 75% of canopy cover C-13
B. Deciduous vegetation providing > 75% of canopy cover C-14
C. Mixed woodlands with both deciduous and evergreen providing at least 25% of canopy cover C-14
III. SHRUBLANDS—Uppermost stratum is primarily shrub species or cane. Trees covering < 25% of the sampling area may be present. C-15
A. Evergreen canebrakes; deciduous vegetation is < 75% of the uppermost stratum C-15
B. Deciduous vegetation is >75% of the uppermost stratum (includes some disturbance-related upland shrublands that may have some eastern red-cedar) C-15
IV. HERBACEOUS COMMUNITIES—Uppermost stratum is primarily herbaceous species, > 25% cover. C-16
A. Natural or cultivated upland grassland (cool-season and warm-season) C-16
B. Fens and marshes (saturated soil areas associated with seeps, edges of ponds and floating aquatic vegetation) C-16
C. Glades (i.e. herbaceous communities on areas with rock outcrops at the surface; eastern red-cedar may be present, but should be < 25% in order to key here; see also evergreen forests and woodlands if eastern red-cedar cover is > 25%) C-17
V. SPARSE HERBACEOUS COMMUNITIES—Uppermost stratum is primarily herbaceous species, < 15% cover C-18
A. Talus sparse vegetation C-18
B. Cobble - gravel - sand bar sparse vegetation C-18

NATURAL AND SEMI-NATURAL COMMUNITIES

I. FORESTS—Communities with the uppermost stratum composed of large trees, generally >15 m tall. Canopy cover is greater than 60%, usually with crowns touching or overlapping and little visible sky between crowns. Other than tree-fall gaps, canopy height and cover are fairly uniform, creating more or less complete shade. Tree and shrub layers generally discrete, forming a multi-layered community.

A. Forests with evergreen vegetation providing > 75% of canopy cover

1. Predominantly Pine (*Pinus spp)* OR Eastern red-cedar/Juniper (*Juniperus spp*.) dominated forests or woodlands

A. Predominantly Pine (*Pinus spp)* forest

i. Planted Pine forest (resulting from establishment of a plantation)

a. Planted stand of Loblolly Pine (*Pinus taeda*)	7179	Loblolly Pine Plantation
b. Planted stand of Shortleaf Pine (*Pinus echinata*)	7169	Shortleaf Pine Plantation

ii. Natural/semi-natural Pine forest (not a planted stand, includes regeneration or managed)

a. Pine forest. Pine >75% canopy cover usually results from timber management. Shrubs and groundflora are sparse, dominated by plants that thrive in acid soils. This Association was not recorded or sampled at BUFF but probably occurs, recorded at Gene Rush WMA (Plot 755). Some distinctions between our local description of this type and the existing description in the NVC – in the Ozarks, 2400 usually results from timber management (not mentioned in the NVC description), it can occur on both acid and calcareous substrates (only acidic substrates mentioned in the NVC description), it can be dry mesic as well as dry (only dry in the NVC desc) and can have substantial amounts of Eastern red-cedar (which is not mentioned in the NVC description).	2400	Interior Highlands Shortleaf Pine / Blueberry Forest

b. Dense, relatively young shortleaf pine community that results from seeding into open areas following natural or anthropogenic disturbance. Associated species may include sweetgum and oaks. May succeed into 2400 following thinning and/or fire. Uncommon to rare at BUFF.

6327 Early-Successional Shortleaf Pine Forest

B. Red-cedar dominated forests with scattered hardwoods. Oaks are often present in the canopy, with plants that thrive in basic soils common in the shrub and groundflora layers. Although characteristically forest structure, this type may be more open and more diverse as it succeeds toward a more natural type. This type is successional from CROPLAND and should display evidence of that such as furrows, rock walls, invasive species, leveled ground, etc.

7124 Successional Eastern Red-cedar Forest

(4803 Ozark Red-cedar - Hardwood Forest can key here – it is not successional from cropland, but possibly from pasture; also can be found on degraded glades)

2. Mixed Pine (*Pinus spp)* AND Eastern red-cedar/Juniper (*Juniperus spp*.) dominated forests

7816 Red-cedar - Pine - Elm Successional Ozark Forest

B. Forests with deciduous vegetation providing > 75% of canopy cover

1. Upland forests of summits, slopes, and small drains and intermittent streams not dominated by annual flooding activity **[3 choices]**

a. Communities of dry sites on summits, upper south-facing slopes and thin soils. Cover typically from 60-90%. Understory and groundflora are sparse, dominated by species that thrive in dry soils. Typical canopy components include post oak, black oak, and/or blackjack oak. Association 2076 (below) is a DRY forest, dominated by black oak with white oak, also placed here but was mapped with Dry-mesic forests due to compositional similarity.

i. Dry, typically acid forest dominated by post, black and/or blackjack oaks. Shrub and groundflora layers are usually sparse, dominated by plants that thrive in acid soils..

2075 Midwest Post Oak - Black jack Oak Forest

ii. Dry to dry-mesic forests with black oak predominant. Canopy cover is generally more than 80%. Dogwood and blackgum (and sometimes blueberry) below. Groundflora variable; plants that thrive in acid soils and generalists. Trees are

short in stature. Compare to 4270 in dry-mesic forests (b. below).

b. Communities of dry-mesic sites of mid and lower south-facing slopes and other areas with moderately deep soils. Understory moderately rich and diverse, particularly on calcareous substrates. Typical canopy components include northern red oak, southern red oak, black oak, and white oak, with mockernut hickory and pignut hickory. Chinquapin oak and shagbark hickory may or may not be present. **[3 choices]**

   i. Communities of dry-mesic acidic sites underlain by sandstone, chert and sometimes shale. Northern red oak, black oak typically present; chinquapin oak, shagbark hickory absent; shrub and groundflora less diverse than [ii] below. **[3 choices]**

      (i) White oak, northern red oak, mockernut hickory and pignut hickory with >75% canopy cover. Chinquapin oak and shagbark hickory absent or low in abundance in the canopy and subcanopy. Flowering dogwood is dominant in the understory with a dense shrub and ground flora layer. Stands have few calciphiles. Matrix community on acidic geologies.

      (ii) Black oak is an important component of this community that occurs on sites that are moister than those of CEGL002076 above. Dominant trees are tall. Northern red oak may be present

      (iii) Southern red oak co-dominates with white oak in this community.

   ii. Communities of dry-mesic calcareous sites underlain by limestone, dolomite, and sometimes shale (e.g. Fayetteville) or sandstone (e.g. St. Peter). Chinquapin oak present to co-dominant, shagbark hickory present, shrub and groundflora more diverse than [i] above.

      (i) White oak, chinquapin oak, shagbark hickory, and ash dominated communities with calciphiles in all layers. Chinquapin oak and ash may be more important in lower layers than in the canopy. Elm and sugar maple may be abundant in the understory. Pawpaw and spicebush are usually abundant in the understory/shrub layer, along

2076 Black Oak - White Oak - Hickory Forest

2067 White Oak - Red Oak Dry-Mesic Acidic Forest

4270 Ozark-Ouachita Dry-Mesic - White Oak - Black Oak - Hickory Forest

4543 Eastern Oklahoma Dry-Mesic Oak - Hickory Forest

with sugar maple. Matrix community on calcareous geologies.

2070 White Oak - Mixed Oak Dry-Mesic Alkaline Forest

(ii) Chinquapin oak and Shumard oak share dominance in this community. Only one plot documented.

4602 Chinquapin Oak - Shumard Oak Ozark Forest

iii. Successional communities of dry-mesic sites **[4 choices]**

(i) Sweetgum forests generally established in abandoned cropland. Stands often have intermixed white oak and southern red oak and are later in succession than pure sweetgum stands.

7217 Interior Mid- to Late-Successional Sweetgum - Oak Forest

(ii) Abandoned cropland dominated by black locust (*Robinia pseudoacacia*). Associated species are highly variable depending on such things as site history and time since establishment.

7279 Successional Black Locust Forest

(iii) Stand dominated by honey-locust (*Gleditsia triacanthos*) with black walnut

4345 Ozark Honey-locust - Black Walnut Woodland

(iv) Stand dominated by Osage-orange (*Maclura pomifera*)

6627 Osage-orange Successional Forest

c. Communities of mesic sites of steep north-facing slopes or protected ravines or slopes. Beech or sugar maple are characteristic but seldom co-dominate. Understory often rich and diverse, particularly on calcareous sites. **[3 choices]**

i. White oak, northern red oak and sugar maple co-dominate in the overstory. American Basswood may be present. Understory, shrub and groundflora layers are usually dense and diverse. Moisture-loving calciphiles are often present, and may dominate the shrub and groundflora layers. Often on calcareous substrates.

2058 White Oak - Red Oak - Sugar Maple Forest

ii. Beech is the characteristic dominant, sometimes in a fairly pure stand, and at other times with a variety of other species such as northern red oak, basswood or umbrella magnolia. Sugar maple may co-dominate. Often occurs on limestone. Far more likely in upper Buffalo River.

7823 Ozark Rich Beech - Mixed Hardwood Forest

2. Bottomland and riparian forests associated with rivers and creeks, as well as drains and intermittent streams, dominated by annual flooding activity.

    a. Forests of larger floodplains, including the Buffalo River itself, Little Buffalo River, Richland Creek, Big Creek(s), Calf Creek, Bear Creek, Smith Creek from bridge to Buffalo River, (& possibly others) that discharge into the main stem Buffalo River **[3 choices]**

        i. Forests of low floodplains.

            a) Floodplain forests dominated by silver maple, often accompanied by American elm, sycamore, birch and others. Plot 120 is the only one that fits well so it does exist at BUFF.

            b) River birch and sycamore dominated communities that are on fronts beside medium or larger streams in dynamic, successional, high-light situations. This is the most common low riverfront community at BUFF in dynamic riparian zones. Sometimes forest, sometimes shrubby on bars. [also keys in shrubland]

        ii. Forests of terraces, terrace slopes, and high floodplains, generally more stable disturbance regime with less scour than the previous communities, and with later-successional species. These may be oak-hickory-maple forests or elm-ash-sugarberry forests. Canopy cover may be < 60% in some cases. Cane (*Arundinaria*) may be an indicator of this environment.

            a) Forests primarily dominated by species such as ash, elm, sugarberry, and sycamore; oaks are a possible component of some associations, but are usually not dominant

                i) Ash and hardwood (oak) dominated communities on terraces and terrace slopes, upper stable floodplains, often with oaks. Sycamore is distinctively less abundant in this community compared to 2086. Early successional species are often abundant, but usually <50% of cover in the uppermost stratum. Groundflora is somewhat more diverse than

2586 Silver Maple - Elm Forest

2086 River Birch - Sycamore Small River Floodplain Forest

communities of more dynamic sites, especially in higher, more stable areas of this community.

ii) Sites dominated by Ash with sugarberry and elm. Difficult to distinguish from 2410, which is much more common.

b) Forests of higher, less frequently flooded terraces in which oaks, hickories, and other later-successional species including sugar maple dominate.

i) Mixed oak forest on high terraces flooded for short durations, dominated by bur oak in combination with a variety of other species characteristic of both uplands and floodplains. All extensive areas of this forest along the Buffalo have been cleared for cropland, now pasture or recreation areas. A few areas too small to have been cleared are all that remain.

iii. Box-elder is typically strongly dominant (> 80%). Stands may also include elm, black walnut, honey locust, *Prunus* spp., etc. (hardwoods that respond favorably to human disturbance) as the prominent woody component in all layers. Forest usually simple in structure with dense, short canopy and open shrub and groundflora layers. Not very diverse, of limited extent and on wider/larger floodplain areas. Assignment of plots or areas to this Association is based on species composition, not evidence of disturbance. Often, large open-grown oaks may be present. Early successional species are usually found in the shrub and groundflora layers. These may include members of the genera *Prunus, Rubus* and *Rhus*. Some examples are "early-successional" - but this may be a stable community once established.

b. Riparian forests primarily found along smaller streams (but could be found on narrower floodplains along the Buffalo River).

i. Forests often co-dominated by box-elder, typically overtopped by sycamore and cottonwood, but with a fairly high diversity of other species (see description), generally along floodplains of smaller streams, but also on narrower floodplains along the Buffalo River.

2410 Ash - Oak - Sycamore Mesic Bottomland Forest

2427 Southern Green Ash - Elm - Sugarberry Forest

4544 Bur Oak - Shumard Oak Bottomland Forest

5033 Box-elder Floodplain Forest

4690 Southern Interior Box-elder Riparian Forest

ii. Forests along upper reaches of small streams with little flooding, generally of short duration, with sweetgum consistently present (as an indicator, possibly at low cover value), although a variety of other species (including black walnut, hickories, box elder, slippery elm) may occur. Not as dynamic as 4690 and with less sycamore and river birch.

7826 Ouachita-Ozark Small Stream Hardwood Forest

C. Mixed forests with both deciduous and evergreen vegetation providing at least 25% of relative canopy cover

1. Pine and oak dominated forests

   a. Communities of dry sites of summits, upper south-facing slopes and other areas with thin soils. These are usually somewhat open black oak dominated forests. Canopy cover is 60-80%. Post oak may be abundant in this type, but where coverage is near 60%, classification as woodland might be more appropriate. White oak, mockernut hickory and pignut hickory may be present but are generally subdominant and provide little canopy cover. Black hickory may be abundant. Shrubs and groundflora are usually sparse, mostly plants that thrive in acid soils. Black hickory, blueberry and less commonly dogwood dominate the lower layers. Herbs are sparse, mostly plants that thrive in acid soils. Plots at BUFF are described as dry-mesic or dry ("xeric"). Physiognomy varies from slightly stunted trees 15-20m tall on dry sites to 20-35m tall trees on dry mesic sites. This type is more consistently and easily recognized on dry sites with somewhat stunted trees, there could be confusion with 7489 on dry-mesic sites.

2401 Interior Highlands Shortleaf Pine - Black Oak Forest

   b. Communities of dry-mesic sites; sub-mesic to sub-xeric, usually full-canopied pine, mixed-oak and hickory forests. Cover generally around 80%. White oak, mockernut hickory and pignut hickory may be abundant. Mix of generalists and plants that thrive in acid soils in lower layers. Dogwood and blackgum (sometimes blueberry) are common below. Groundflora variable; plants that thrive in acid soils and generalists, usually with lots of *Desmodium nudiflorum*. Moist soil pockets can create dense shrub and groundflora layers.

7489 Interior Highlands Shortleaf Pine - Oak Dry-Mesic Forest

2. Eastern red-cedar and oak dominated forests

   a. Communities of dry sites of summits, upper south-facing slopes and other areas with thin soils. Eastern red-cedar should be >25%, hardwoods and pine < 25%. Examples of this type are

common at BUFF. They may have either forest or woodland physiognomy. Although soil is typically thin, rock outcrops are limited. They may have been grazed in the past but not cropped and are probably more extensive in today's fire suppressed landscape. There is also possible confusion with 7124

4803 Ozark Red-cedar - Hardwood Forest

II. WOODLANDS—Communities with 15- 60 % canopy cover composed of either a) widely spaced, large trees with often spreading limbs, a poorly developed shrub layer (except where fire damage has caused resprouting), and vigorous herbaceous growth or, b) stunted trees of varying heights where identification of the canopy may be difficult due to intermingling between trees and a dense shrub layer, and where groundflora can be diverse and of variable cover. In the latter example, timber quality is generally poor.

A. Evergreen vegetation providing > 75% of canopy cover

1. Juniper-dominated woodlands on blufftops and steep slopes over exposed bedrock.

   a. Eastern red-cedar dominated dry woodlands generally restricted to narrow blufftops with bedrock near the surface, although many areas at BUFF occupy steep slopes rather than bluffs and therefore are wider. Species that thrive in sunny sites over basic soils dominate. Substrate is usually limestone, sandstone or shale. May be interspersed with Limestone or Dolomite Glades — **2426 Red-cedar Alkaline Bluff Woodland**

   b. Ashe's Juniper dry woodlands; *Juniperus ashei* may be dominant, co-dominant with Eastern red-cedar, or present at lower values, as an indicator species, with Eastern red-cedar.

      i. Ashe's Juniper dominated dry moderate to steep slopes over dolomite and cherty limestone, not on sandstone or shale. Understory is typically sparse. More frequently encountered in the eastern two-thirds of the Park, but can be on steep, dry cherty Boone Formation in the western third. This association is separated from 2426 by the presence of Ashe's juniper, which does not have to be more abundant than eastern red-cedar. — **7833 Ozark Ashe's Juniper Glade Woodland**

      ii. Ashe's Juniper dominated clifftops over dolomite. Distinguishing this association from 7833 must be done with care to be certain this one is on a bluff vs. a steep slope. As an added complication, a band of 4672 might occur above a shelf of 4672 100ft or more down the face of the bluff and look to the mappers like a steep slope. — **4672 Ozark Ashe's Juniper Clifftop Woodland**

2. Pine dominated woodlands, usually restricted to acidic soils and associated with sandstone bedrock at or near the surface. Red-cedar may be present, though pine usually forms an emergent layer above. If found at BUFF this would likely be like an open phase of 2400. A plot of this type was sampled in Gene Rush WMA adjacent to BUFF which was created through silvicultural thinning of a managed pine stand, and it fits the description of 2400. — 2400 Interior Highlands Shortleaf Pine / Blueberry Forest

B. Deciduous vegetation providing > 75% of canopy cover

1. Generally dry-mesic woodlands dominated by species with broad moisture tolerance such as white oak, post oak and black oak. Ground cover is often grass-dominated with little bluestem common. This community is maintained as a woodland primarily by frequent fire rather than xeric site conditions and as such the association often occurs at BUFF as a forest due to fire suppression. The forest should usually be typed 2076.

2150 White Oak - Post Oak / Bluestem Ozark Woodland

2. Xeric to dry woodlands dominated by post and blackjack oak if on acidic substrate, usually with black hickory; with chinquapin oak, post oak, and ash if on calcareous substrate. Post oak has less value as an indicator, it may be present to dominant in either 2143 or 2149. **[3 choices]**

   A. Woodlands restricted to limestone or dolomite outcrops and dominated by chinquapin oak, blue ash and other calciphiles. Dominated by calciphiles in all layers. Eastern red-cedar may be present. May be quite dense in shrub layer due to open canopy, especially where fire has been absent. In glade-woodland complexes, this association may be found with glade (herbaceous) associations 2398 or 2251. **2143**

Chinkapin Oak - Ash / Little Bluestem Woodland

   B. Mixed acidic-affinity oaks adapted to xeric conditions, such as post and blackjack oak dominate, often with black hickory. **2149**

Ozark/Ouachita Post Oak - Blackjack Oak / Little Bluestem Woodland

   C. Stunted, though often dense, canopy of predominately blackjack oak and/or black hickory No plots assigned to this association but several are borderline. This should be reserved for shrub or very small tree physiognomy, generally acidic substrates.

2425 Blackjack Oak Xeric Scrub

C. Mixed woodlands with both deciduous and evergreen providing at least 25% of canopy cover

   i. Dry to xeric woodland. Woodlands dominated by shortleaf pine often forming an emergent canopy over oak species such as post oak and black oak. Typically but not always on chert. Drier than 7489 with trees more stunted.

2393 Ozark/Ouachita Shortleaf Pine - Oak Dry Woodland

III. SHRUBLANDS—Uppermost stratum is primarily shrub species or cane. Trees covering < 25% of the sampling area may be present.

A. Evergreen canebrakes; deciduous vegetation is < 75% of the uppermost stratum

1. Temporarily flooded evergreen shrubland. These are dense stands of cane without a tree canopy above—limited to river bottoms and terraces. Typically does not occur in the lowest, most dynamic riverfront where 2086 is the typical community, but may be found on any higher wetland and mesic upland sites. Most common on field edges with high sunlight and periodic moderate disturbance.

3836 Floodplain Canebrake

B. Deciduous vegetation is >75% of the uppermost stratum (includes some disturbance-related upland shrublands that may have some eastern red-cedar)

1. Upland deciduous (or mixed) shrublands. These are poorly-documented mixtures of shrubs resulting from regular and/or recent disturbance. Typical locations include edges of herbaceous fields, forest openings, and utility corridors (rights-of-way). May include young trees that are shrub height (< 5 meters). Some Eastern red-cedar may be present, this could result in a mixed composition.

G583 Southeastern Old Field Group (no association)

2. Wetland shrublands, including saturated, temporarily flooded, or seasonally flooded; including gravel bars on rivers, and gravel washes along minor waterways and drains

   a. Deciduous shrubland, saturated, temporarily flooded, or seasonally flooded, dominated by *Alnus serrulata*

3894 Interior Alder Shrubland

   b. Temporarily flooded deciduous shrubland, not dominated by *Alnus serrulata*; in particular gravel bars on rivers, and gravel washes along minor waterways and drains **[3 choices]**

      i. Witch-hazel, rough-leaved dogwood, and indigo bush (*Amorpha fruticosa*) dominated communities, often with willow, ash and sycamore present but less dominant. Generally in gravel washes along minor waterways and drains, but can occur on protected gravel bars.

3898 Witch-hazel - Dogwood Gravel Wash

      ii. Willow and/or young sycamore dominated. Generally restricted to gravel bars on larger rivers.

7064 Carolina Willow Ozark Shrubland

      iii. Flood-scoured river birch and sycamore dominate. A version of 2086 can occur as a shrubland in very dynamic bars.

2086 River Birch - Sycamore Small River Floodplain Forest

IV. HERBACEOUS COMMUNITIES—Uppermost stratum is primarily herbaceous species, > 25% cover.

A. ***Natural or cultivated upland grassland*** *(cool-season and warm-season)*

1. Cultivated cool-season grass pastureland, although not always grazed. Sometimes maintained at BUFF by prescribed fire to preserve historic landscape and/or provide elk grazing habitat. Occurs at BUFF but was not recorded at any plots. Primarily dominated by Fescues (*Lolium [Festuca]* species, with other cool-season grasses.

4048 Cultivated Meadow

2. Cultivated warm-season grass pastureland, although not always grazed. Sometimes maintained at BUFF by prescribed fire to preserve historic landscape and/or provide elk grazing habitat. Occurs at BUFF but was not recorded at any plots. Examples contain *Andropogon virginicus,* but are not necessarily dominated by it; they may contain *Tridens flavus* and other tall to short native forbs and grasses.

4044 Successional Broomsedge Vegetation

B. **Fens and marshes** (saturated soil areas associated with seeps, edges of ponds and floating aquatic vegetation)

1. Fens (saturated soil areas associated with seeps on dolomite substrate); Short (usually < 0.3m), often patchy herbs and sedges on marl soils near bedrock.

2404 Ozark Fen

2. Marshes (includes edges of ponds and floating aquatic vegetation)

a. Emergent wetland vegetation (forb and graminoid dominated)

i. Vegetation dominated by graminoids, tall (e.g. Cattails and rushes) or shorter **[3 choices]**

a. Vegetation dominated by a mixture of tall graminoids (including rushes, bulrushes, and cattails (*Juncus, Schoenoplectus, Typha*) occurring in a large beaver meadow in Boxley Valley which is spring-fed from adjacent uplands, as well as possibly in other still waters of marshes, ditches, and pond margins

2026 Bulrush - Cattail - Bur-reed Shallow Marsh

b. Vegetation of small areas of disturbed and artificial wetlands, including borrow pits, ponds, or roadside ditches; consisting of monospecific stands of *Typha latifolia*

4150 Southern Cattail Marsh

c. Low graminoid vegetation in spring-fed wetland pockets and in the margins & tails of beaver ponds (a possible

map unit not tied to any associations). Examples may include a variety of *Carex* spp. along with *Impatiens capensis* and *Boehmeria cylindrica.*

ii. Vegetation dominated by forbs (not graminoids), typically present in aquatic beds in flowing water of rivers and streams

b. Floating aquatic vegetation (pure water-shield [Brasenia] or mixtures of water-shield and others such as white water-lily [*Nymphaea*], water-lotus [*Nelumbo*], and/or yellow pond-lily [*Nuphar*])

C. Glades *(i.e. herbaceous communities on areas with rock outcrops at the surface; eastern red-cedar may be present, but should be < 25% in order to key here; see also evergreen forests and woodlands if eastern red-cedar cover is > 25%)*

1. Calcareous glades [3 choices]

a. Dolomite glades—Open areas dominated by grasses and forbs on dolomite substrate, primarily in the eastern third of the park. Dominant grasses include *Andropogon gerardii, Danthonia spicata*, and *Schizachyrium scoparium*; with characteristic *Coreopsis* spp., *Desmodium* spp., *Dichanthelium* spp., *Elymus virginicus, Eupatorium altissimum, Galactia regularis, Grindelia lanceolata, Hedyotis nigricans, Helianthus divaricatus, Ruellia humilis, Scleria oligantha,* and *Symphyotrichum oblongifolium*

b. Limestone glades—Open areas dominated by grasses and forbs on limestone substrate [floristics needed] Limestone is typically within the Boone formation that occurs throughout the park, but in different slope positions (lower slope in western third, throughout middle third and mountain tops in eastern third).

c. Glades on sandstone but having a flora with basic affinities. Dominated by post oak in the open woody layer, farkleberry (*Vaccinium arboreum*) in the shrub layer and big bluestem in the herbaceous layer. This is typically on Ordovician sandstones in the eastern third of the park.

2. Acidic glades

a. Glades on sandstone having a flora with acidic affinities. Dominated by little bluestem and three-awn grasses. Typically in the western third of the park.

G557 Southeastern Ruderal Wet Meadow & Marsh Group (no association)

4286 Water-willow Rocky Bar and Shore

4527 Watershield Pond

2398 Ozark Dolomite Glade

2251 Ozark Limestone Glade

7814 Ozark Basic Sandstone Glade

2242 Ozark Sandstone Glade

V. SPARSE HERBACEOUS COMMUNITIES—Uppermost stratum is primarily herbaceous species, < 15% cover

A. Talus sparse vegetation

1. Slopes covered by dolomite talus and dominated by herbaceous calciphiles. Not recorded at BUFF but possibly occurring there.	*2308*	*Midwest Limestone - Dolomite Talus*
2. Slopes covered by sandstone talus. Not recorded at BUFF but possibly occurring there.	*2309*	*Midwest Highlands Sandstone Talus*

B. Cobble - gravel - sand bar sparse vegetation

1. Sparsely vegetated gravel and cobble flats community occurring along large and small rivers	7012	Ozark Riverine Gravel Flats

Appendix D: List of Plant Species

Explanation of the Species List

Plant taxa were identified and documented from vegetation sample plots and accuracy assessment sites collected for the Buffalo National River (BUFF) vegetation mapping project. Plant taxa, along with other sample data, were entered into the National Park Service PLOTS Database Version 2 (NatureServe 2005) for subsequent analyses (plant community descriptions and map assessment). Table D-1 is an export of all plant taxa generated from the PLOTS Database for this project. Note that this list includes taxa identified to the genus, species, and sub-species level. This list is not intended to be comprehensive of every taxon at the BUFF. In addition, the list contains some species not currently found on the park-wide vascular plant species list for the BUFF. Staff at the BUFF has been notified of these species so that follow-up work and confirmation may be completed in the future. The plant taxa list is organized alphabetically by scientific name. Nomenclature follows the PLANTS database (U.S. Department of Agriculture 2004).

Table D-1. Plant species list of Buffalo National River.

Scientific Name	Common Name	Family
Acacia angustissima	prairie acacia	Fabaceae
Acacia angustissima var. *hirta*	prairie acacia	Fabaceae
Acalypha gracilens	slender threeseed mercury (Slender Copperleaf)	Euphorbiaceae
Acalypha monococca	slender threeseed mercury (Single-seed Three-seed-mercury)	Euphorbiaceae
Acalypha ostryifolia	pineland threeseed mercury	Euphorbiaceae
Acalypha virginica	Virginia threeseed mercury	Euphorbiaceae
Acer negundo	boxelder	Aceraceae
Acer rubrum	red maple	Aceraceae
Acer rubrum var. *rubrum*	red maple	Aceraceae
Acer saccharinum	silver maple	Aceraceae
Acer saccharum	sugar maple	Aceraceae
Achillea millefolium	common yarrow	Asteraceae
Actaea pachypoda	white baneberry	Ranunculaceae
Actaea racemosa	black bugbane	Ranunculaceae
Adiantum capillus-veneris	common maidenhair	Pteridaceae
Adiantum pedatum	northern maidenhair	Pteridaceae
Aesculus glabra	Ohio buckeye	Hippocastanaceae
Aesculus pavia	red buckeye	Hippocastanaceae
Agastache nepetoides	yellow giant hyssop	Lamiaceae
Ageratina altissima	white snakeroot	Asteraceae
Agrimonia pubescens	soft agrimony	Rosaceae
Agrimonia rostellata	beaked agrimony	Rosaceae
Agrostis hyemalis	winter bentgrass	Poaceae
Ailanthus altissima	tree of heaven	Simaroubaceae
Aira caryophyllea	silver hairgrass	Poaceae
Aira elegans	annual silver hairgrass	Poaceae
Albizia julibrissin	silktree	Fabaceae
Alisma	water plantain	Alismataceae
Alliaria petiolata	garlic mustard	Brassicaceae
Allium ampeloprasum	broadleaf wild leek	Liliaceae
Allium canadense	meadow garlic	Liliaceae

Scientific Name	Common Name	Family
Allium canadense var. *canadense*	meadow garlic	Liliaceae
Allium stellatum	autumn onion	Liliaceae
Allium vineale	wild garlic	Liliaceae
Alnus serrulata	hazel alder	Betulaceae
Amaranthus palmeri	carelessweed	Amaranthaceae
Amaranthus spinosus	spiny amaranth	Amaranthaceae
Ambrosia artemisiifolia	annual ragweed	Asteraceae
Ambrosia trifida	great ragweed	Asteraceae
Amelanchier arborea	common serviceberry	Rosaceae
Amorpha fruticosa	desert false indigo	Fabaceae
Amorpha ouachitensis	Ouachita false indigo	Fabaceae
Ampelopsis arborea	peppervine	Vitaceae
Ampelopsis cordata	heartleaf peppervine	Vitaceae
Amphicarpaea bracteata	American hogpeanut	Fabaceae
Amsonia illustris	Ozark bluestar	Apocynaceae
Amsonia tabernaemontana	eastern bluestar	Apocynaceae
Andropogon gerardii	big bluestem	Poaceae
Andropogon ternarius	splitbeard bluestem	Poaceae
Andropogon virginicus	broomsedge bluestem	Poaceae
Anemone	anemone	Ranunculaceae
Anemone virginiana	tall thimbleweed	Ranunculaceae
Angelica venenosa	hairy angelica	Apiaceae
Antennaria	pussytoes	Asteraceae
Antennaria plantaginifolia	woman's tobacco	Asteraceae
Apios americana	groundnut	Fabaceae
Apocynum cannabinum	Indianhemp	Apocynaceae
Aquilegia canadensis	red columbine	Ranunculaceae
Arabis canadensis	sicklepod	Brassicaceae
Arabis laevigata	smooth rockcress	Brassicaceae
Aralia racemosa	American spikenard	Araliaceae
Aralia spinosa	devil's walkingstick	Araliaceae
Arctium minus	lesser burdock	Asteraceae
Arenaria serpyllifolia	thymeleaf sandwort	Caryophyllaceae
Arisaema dracontium	green dragon	Araceae
Arisaema triphyllum	Jack in the pulpit	Araceae
Aristida	threeawn	Poaceae
Aristida dichotoma	churchmouse threeawn	Poaceae
Aristida purpurascens	arrowfeather threeawn	Poaceae
Aristolochia reticulata	Texas dutchman's pipe	Aristolochiaceae
Aristolochia serpentaria	Virginia snakeroot	Aristolochiaceae
Aristolochia tomentosa	woolly dutchman's pipe	Aristolochiaceae
Arnoglossum atriplicifolium	pale Indian plaintain	Asteraceae
Arnoglossum muehlenbergii	great Indian plaintain	Asteraceae
Arnoglossum plantagineum	groovestem Indian plaintain	Asteraceae
Arundinaria gigantea	giant cane	Poaceae
Asarum canadense	Canadian wildginger	Aristolochiaceae
Asclepias	milkweed	Asclepiadaceae
Asclepias hirtella	green milkweed	Asclepiadaceae

Scientific Name	Common Name	Family
Asclepias quadrifolia	fourleaf milkweed	Asclepiadaceae
Asclepias tuberosa	butterfly milkweed	Asclepiadaceae
Asclepias variegata	redring milkweed	Asclepiadaceae
Asclepias verticillata	whorled milkweed	Asclepiadaceae
Asclepias viridiflora	green comet milkweed	Asclepiadaceae
Asimina triloba	pawpaw	Annonaceae
Asplenium platyneuron	ebony spleenwort	Aspleniaceae
Asplenium resiliens	blackstem spleenwort	Aspleniaceae
Asplenium rhizophyllum	walking fern	Aspleniaceae
Astragalus canadensis	Canadian milkvetch	Fabaceae
Astragalus crassicarpus	groundplum milkvetch	Fabaceae
Astranthium integrifolium ssp. ciliatum	entireleaf western daisy	Asteraceae
Athyrium filix-femina ssp. *asplenioides*	asplenium ladyfern	Dryopteridaceae
Aureolaria flava	smooth yellow false foxglove	Scrophulariaceae
Aureolaria grandiflora	largeflower yellow false foxglove	Scrophulariaceae
Aureolaria pectinata	combleaf yellow false foxglove	Scrophulariaceae
Baptisia alba	white wild indigo	Fabaceae
Baptisia bracteata	longbract wild indigo	Fabaceae
Baptisia bracteata var. *leucophaea*	longbract wild indigo	Fabaceae
Berchemia scandens	Alabama supplejack	Rhamnaceae
Betula nigra	river birch	Betulaceae
Bidens	beggarticks	Asteraceae
Bidens cernua	nodding beggartick	Asteraceae
Bidens frondosa	devil's beggartick	Asteraceae
Blephilia ciliata	downy pagoda-plant	Lamiaceae
Blephilia hirsuta	hairy pagoda-plant	Lamiaceae
Boehmeria cylindrica	smallspike false nettle	Urticaceae
Botrychium biternatum	sparselobe grapefern	Ophioglossaceae
Botrychium dissectum	cutleaf grapefern	Ophioglossaceae
Botrychium virginianum	rattlesnake fern	Ophioglossaceae
Bouteloua curtipendula	sideoats grama	Poaceae
Brachyelytrum erectum	bearded shorthusk	Poaceae
Brasenia schreberi	watershield	Cabombaceae
Brickellia eupatorioides	false boneset	Asteraceae
Brickellia grandiflora	tasselflower brickellbush	Asteraceae
Bromus commutatus	meadow brome	Poaceae
Bromus japonicus	Japanese brome	Poaceae
Bromus latiglumis	earlyleaf brome	Poaceae
Bromus pubescens	hairy woodland brome	Poaceae
Bromus secalinus	rye brome	Poaceae
Callicarpa americana	American beautyberry	Verbenaceae
Calycocarpum lyonii	cupseed	Menispermaceae
Calystegia sepium	hedge false bindweed	Convolvulaceae
Camassia scilloides	Atlantic camas	Liliaceae
Campanulastrum americanum	American bellflower	Campanulaceae
Campsis radicans	trumpet creeper	Bignoniaceae
Cardamine concatenata	cutleaf toothwort	Brassicaceae
Cardamine hirsuta	hairy bittercress	Brassicaceae

Scientific Name	Common Name	Family
Cardamine parviflora var. *arenicola*	sand bittercress	Brassicaceae
Carex albicans	whitetinge sedge	Cyperaceae
Carex albursina	white bear sedge	Cyperaceae
Carex aureolensis	caric sedge	Cyperaceae
Carex blanda	eastern woodland sedge	Cyperaceae
Carex bushii	Bush's sedge	Cyperaceae
Carex cephalophora	oval-leaf sedge	Cyperaceae
Carex crawei	Crawe's sedge	Cyperaceae
Carex digitalis	slender woodland sedge	Cyperaceae
Carex eburnea	bristleleaf sedge	Cyperaceae
Carex festucacea	fescue sedge	Cyperaceae
Carex frankii	Frank's sedge	Cyperaceae
Carex glaucodea	blue sedge	Cyperaceae
Carex granularis	limestone meadow sedge	Cyperaceae
Carex hirsutella	fuzzy wuzzy sedge	Cyperaceae
Carex hirtifolia	pubescent sedge	Cyperaceae
Carex hitchcockiana	Hitchcock's sedge	Cyperaceae
Carex jamesii	James' sedge	Cyperaceae
Carex laevivaginata	smoothsheath sedge	Cyperaceae
Carex leavenworthii	Leavenworth's sedge	Cyperaceae
Carex mesochorea	midland sedge	Cyperaceae
Carex molesta	troublesome sedge	Cyperaceae
Carex muehlenbergii	Muhlenberg's sedge	Cyperaceae
Carex oligocarpa	richwoods sedge	Cyperaceae
Carex pensylvanica	Pennsylvania sedge	Cyperaceae
Carex radiata	eastern star sedge	Cyperaceae
Carex retroflexa	reflexed sedge	Cyperaceae
Carex rosea	rosy sedge	Cyperaceae
Carex shortiana	Short's sedge	Cyperaceae
Carex tribuloides	blunt broom sedge	Cyperaceae
Carex umbellata	parasol sedge	Cyperaceae
Carex vulpinoidea	fox sedge	Cyperaceae
Carex willdenowii	Willdenow's sedge	Cyperaceae
Carpinus caroliniana	American hornbeam	Betulaceae
Carya	hickory	Juglandaceae
Carya alba	mockernut hickory	Juglandaceae
Carya cordiformis	bitternut hickory	Juglandaceae
Carya glabra	pignut hickory	Juglandaceae
Carya ovata	shagbark hickory	Juglandaceae
Carya texana	black hickory	Juglandaceae
Castanea pumila	chinkapin	Fagaceae
Castanea pumila var. *ozarkensis*	Ozark chinkapin	Fagaceae
Catalpa bignonioides	southern catalpa	Bignoniaceae
Catalpa speciosa	northern catalpa	Bignoniaceae
Caulophyllum thalictroides	blue cohosh	Berberidaceae
Ceanothus americanus	New Jersey tea	Rhamnaceae
Celastrus scandens	American bittersweet	Celastraceae
Celtis laevigata	sugarberry	Ulmaceae

Scientific Name	Common Name	Family
Celtis occidentalis	common hackberry	Ulmaceae
Celtis tenuifolia	dwarf hackberry	Ulmaceae
Cephalanthus occidentalis	common buttonbush	Rubiaceae
Cerastium fontanum	common mouse-ear chickweed	Caryophyllaceae
Cercis canadensis	eastern redbud	Fabaceae
Chaerophyllum	chervil	Apiaceae
Chaerophyllum tainturieri	hairyfruit chervil	Apiaceae
Chaerophyllum tainturieri var. *tainturieri*	hairyfruit chervil	Apiaceae
Chamaecrista	sensitive pea	Fabaceae
Chamaecrista fasciculata	sleepingplant	Fabaceae
Chamaesyce maculata	spotted sandmat	Euphorbiaceae
Chamaesyce nutans	eyebane	Euphorbiaceae
Chasmanthium latifolium	Indian woodoats	Poaceae
Chasmanthium laxum	slender woodoats	Poaceae
Chasmanthium sessiliflorum	longleaf woodoats	Poaceae
Cheilanthes alabamensis	Alabama lipfern	Pteridaceae
Cheilanthes lanosa	hairy lipfern	Pteridaceae
Chenopodium	goosefoot	Chenopodiaceae
Chenopodium album	lateflowering goosefoot	Chenopodiaceae
Chenopodium ambrosioides	Mexican tea	Chenopodiaceae
Chenopodium standleyanum	Standley's goosefoot	Chenopodiaceae
Chionanthus virginicus	white fringetree	Oleaceae
Chloris verticillata	tumble windmill grass	Poaceae
Cicuta maculata	spotted water hemlock	Apiaceae
Circaea lutetiana ssp. *canadensis*	broadleaf enchanter's nightshade	Onagraceae
Cirsium	thistle	Asteraceae
Cirsium altissimum	tall thistle	Asteraceae
Cirsium vulgare	bull thistle	Asteraceae
Cissus trifoliata	sorrelvine	Vitaceae
Cladina	reindeer lichen	Cladoniaceae
Cladonia	cup lichen	Cladoniaceae
Cladrastis kentukea	Kentucky yellowwood	Fabaceae
Clematis catesbyana	satincurls	Ranunculaceae
Clematis reticulata	netleaf leather flower	Ranunculaceae
Clematis versicolor	pale leather flower	Ranunculaceae
Clinopodium arkansanum	limestone calamint	Lamiaceae
Clitoria mariana	Atlantic pigeonwings	Fabaceae
Cocculus carolinus	Carolina coralbead	Menispermaceae
Comandra umbellata	bastard toadflax	Santalaceae
Commelina communis	Asiatic dayflower	Commelinaceae
Commelina erecta	whitemouth dayflower	Commelinaceae
Commelina virginica	Virginia dayflower	Commelinaceae
Conium maculatum	poison hemlock	Apiaceae
Conoclinium coelestinum	blue mistflower	Asteraceae
Convolvulus arvensis	field bindweed	Convolvulaceae
Conyza canadensis	Canadian horseweed	Asteraceae
Coreopsis grandiflora	largeflower tickseed	Asteraceae
Coreopsis grandiflora var. *saxicola*	largeflower tickseed	Asteraceae

Scientific Name	Common Name	Family
Coreopsis lanceolata	lanceleaf tickseed	Asteraceae
Coreopsis palmata	stiff tickseed	Asteraceae
Coreopsis tinctoria	golden tickseed	Asteraceae
Coreopsis tripteris	tall tickseed	Asteraceae
Cornus	dogwood	Cornaceae
Cornus amomum	silky dogwood	Cornaceae
Cornus drummondii	roughleaf dogwood	Cornaceae
Cornus florida	flowering dogwood	Cornaceae
Cornus obliqua	silky dogwood	Cornaceae
Corydalis	fumewort	Fumariaceae
Corydalis flavula	yellow fumewort	Fumariaceae
Corylus americana	American hazelnut	Betulaceae
Cotinus obovatus	American smoketree	Anacardiaceae
Crataegus	hawthorn	Rosaceae
Crataegus calpodendron	pear hawthorn	Rosaceae
Crataegus crus-galli	cockspur hawthorn	Rosaceae
Crataegus intricata	Copenhagen hawthorn	Rosaceae
Crataegus uniflora	dwarf hawthorn	Rosaceae
Crotalaria	rattlebox	Fabaceae
Croton glandulosus var. *septentrionalis*	vente conmigo	Euphorbiaceae
Croton michauxii	Michaux's croton	Euphorbiaceae
Croton monanthogynus	prairie tea	Euphorbiaceae
Croton willdenowii	Willdenow's croton	Euphorbiaceae
Cruciata pedemontana	piedmont bedstraw	Rubiaceae
Cryptotaenia canadensis	Canadian honewort	Apiaceae
Cucurbita	gourd	Cucurbitaceae
Cucurbita pepo var. *ozarkana*	Ozark melon	Cucurbitaceae
Cunila origanoides	common dittany	Lamiaceae
Cuscuta	dodder	Cuscutaceae
Cuscuta gronovii	scaldweed	Cuscutaceae
Cynanchum laeve	honeyvine	Asclepiadaceae
Cynodon dactylon	Bermudagrass	Poaceae
Cynoglossum virginianum	wild comfrey	Boraginaceae
Cynosurus echinatus	bristly dogstail grass	Poaceae
Cyperus	flatsedge	Cyperaceae
Cyperus echinatus	globe flatsedge	Cyperaceae
Cyperus esculentus	yellow nutsedge	Cyperaceae
Cyperus lupulinus	Great Plains flatsedge	Cyperaceae
Cyperus lupulinus ssp. *macilentus*	Great Plains flatsedge	Cyperaceae
Cypripedium	lady's slipper	Orchidaceae
Cystopteris protrusa	lowland bladderfern	Dryopteridaceae
Cystopteris tennesseensis	Tennessee bladderfern	Dryopteridaceae
Cystopteris tenuis	upland brittle bladderfern	Dryopteridaceae
Dactylis glomerata	orchardgrass	Poaceae
Dalea	prairie clover	Fabaceae
Dalea candida	white prairie clover	Fabaceae
Dalea purpurea	violet prairie clover	Fabaceae
Danthonia	oatgrass	Poaceae

Scientific Name	Common Name	Family
Danthonia spicata	poverty oatgrass	Poaceae
Datura	jimsonweed	Solanaceae
Daucus carota	Queen Anne's lace	Apiaceae
Daucus pusillus	American wild carrot	Apiaceae
Delphinium carolinianum	Carolina larkspur	Ranunculaceae
Delphinium newtonianum	Newton's larkspur	Ranunculaceae
Delphinium treleasei	glade larkspur	Ranunculaceae
Delphinium tricorne	dwarf larkspur	Ranunculaceae
Desmodium	ticktrefoil	Fabaceae
Desmodium canescens	hoary ticktrefoil	Fabaceae
Desmodium ciliare	hairy small-leaf ticktrefoil	Fabaceae
Desmodium cuspidatum	largebract ticktrefoil	Fabaceae
Desmodium glutinosum	pointedleaf ticktrefoil	Fabaceae
Desmodium laevigatum	smooth ticktrefoil	Fabaceae
Desmodium marilandicum	smooth small-leaf ticktrefoil	Fabaceae
Desmodium nudiflorum	nakedflower ticktrefoil	Fabaceae
Desmodium paniculatum	panicledleaf ticktrefoil	Fabaceae
Desmodium pauciflorum	fewflower ticktrefoil	Fabaceae
Desmodium perplexum	perplexed ticktrefoil	Fabaceae
Desmodium rotundifolium	prostrate ticktrefoil	Fabaceae
Desmodium sessilifolium	sessileleaf ticktrefoil	Fabaceae
Desmodium viridiflorum	velvetleaf ticktrefoil	Fabaceae
Dianthus armeria	Deptford pink	Caryophyllaceae
Diarrhena americana	American beakgrain	Poaceae
Diarrhena obovata	obovate beakgrain	Poaceae
Dichanthelium acuminatum	tapered rosette grass	Poaceae
Dichanthelium acuminatum var. *acuminatum*	tapered rosette grass	Poaceae
Dichanthelium acuminatum var. *lindheimeri*	Lindheimer panicgrass	Poaceae
Dichanthelium boscii	Bosc's panicgrass	Poaceae
Dichanthelium clandestinum	deertongue	Poaceae
Dichanthelium commutatum	variable panicgrass	Poaceae
Dichanthelium depauperatum	starved panicgrass	Poaceae
Dichanthelium dichotomum	cypress panicgrass	Poaceae
Dichanthelium laxiflorum	openflower rosette grass	Poaceae
Dichanthelium linearifolium	slimleaf panicgrass	Poaceae
Dichanthelium malacophyllum	softleaf rosette grass	Poaceae
Dichanthelium oligosanthes	Heller's rosette grass	Poaceae
Dichanthelium oligosanthes var. *scribnerianum*	Scribner's rosette grass	Poaceae
Dichanthelium ravenelii	Ravenel's rosette grass	Poaceae
Dichanthelium scoparium	velvet panicum	Poaceae
Dichanthelium sphaerocarpon	roundseed panicgrass	Poaceae
Dichondra carolinensis	Carolina ponysfoot	Convolvulaceae
Dicliptera brachiata	branched foldwing	Acanthaceae
Digitaria	crabgrass	Poaceae
Digitaria ciliaris	southern crabgrass	Poaceae
Digitaria cognata	Carolina crabgrass	Poaceae
Digitaria sanguinalis	hairy crabgrass	Poaceae
Diodia teres	poorjoe	Rubiaceae

Scientific Name	Common Name	Family
Diodia virginiana	Virginia buttonweed	Rubiaceae
Dioscorea oppositifolia	Chinese yam	Dioscoreaceae
Dioscorea quaternata	fourleaf yam	Dioscoreaceae
Dioscorea villosa	wild yam	Dioscoreaceae
Diospyros virginiana	common persimmon	Ebenaceae
Dirca palustris	eastern leatherwood	Thymelaeaceae
Dodecatheon meadia	pride of Ohio	Primulaceae
Draba cuneifolia	wedgeleaf draba	Brassicaceae
Dryopteris marginalis	marginal woodfern	Dryopteridaceae
Dysphania	dysphania	Chenopodiaceae
Echinacea pallida	pale purple coneflower	Asteraceae
Echinacea purpurea	eastern purple coneflower	Asteraceae
Echinochloa muricata	rough barnyardgrass	Poaceae
Echinodorus tenellus	mudbabies	Alismataceae
Eleocharis	spikerush	Cyperaceae
Eleocharis compressa	flatstem spikerush	Cyperaceae
Eleocharis obtusa	blunt spikerush	Cyperaceae
Elephantopus carolinianus	Carolina elephantsfoot	Asteraceae
Eleusine indica	Indian goosegrass	Poaceae
Ellisia nyctelea	Aunt Lucy	Hydrophyllaceae
Elymus	wildrye	Poaceae
Elymus hystrix	eastern bottlebrush grass	Poaceae
Elymus macgregorii		Poaceae
Elymus riparius	riverbank wildrye	Poaceae
Elymus villosus	hairy wildrye	Poaceae
Elymus virginicus	Virginia wildrye	Poaceae
Elymus virginicus var. *virginicus*	Virginia wildrye	Poaceae
Enemion biternatum	eastern false rue anemone	Ranunculaceae
Epifagus virginiana	beechdrops	Orobanchaceae
Equisetum	horsetail	Equisetaceae
Equisetum hyemale	scouringrush horsetail	Equisetaceae
Equisetum hyemale var. *affine*	scouringrush horsetail	Equisetaceae
Eragrostis elliottii	field lovegrass	Poaceae
Eragrostis pectinacea	tufted lovegrass	Poaceae
Eragrostis spectabilis	purple lovegrass	Poaceae
Erechtites hieraciifolia	American burnweed	Asteraceae
Erigeron annuus	eastern daisy fleabane	Asteraceae
Erigeron pulchellus	robin's plantain	Asteraceae
Erigeron strigosus	prairie fleabane	Asteraceae
Erigeron tenuis	slenderleaf fleabane	Asteraceae
Eriogonum lonchophyllum var. *lonchophyllum*	spearleaf buckwheat	Polygonaceae
Eriogonum longifolium	longleaf buckwheat	Polygonaceae
Eryngium yuccifolium	button eryngo	Apiaceae
Euonymus americanus	strawberry bush	Celastraceae
Euonymus atropurpureus	eastern wahoo	Celastraceae
Euonymus obovatus	running strawberry bush	Celastraceae
Eupatorium	thoroughwort	Asteraceae
Eupatorium album	white thoroughwort	Asteraceae

Scientific Name	Common Name	Family
Eupatorium altissimum	tall thoroughwort	Asteraceae
Eupatorium purpureum	sweetscented joepyeweed	Asteraceae
Eupatorium serotinum	lateflowering thoroughwort	Asteraceae
Eupatorium sessilifolium	upland boneset	Asteraceae
Euphorbia	spurge	Euphorbiaceae
Euphorbia commutata	tinted woodland spurge	Euphorbiaceae
Euphorbia corollata	flowering spurge	Euphorbiaceae
Euphorbia cyathophora	fire on the mountain	Euphorbiaceae
Euphorbia davidii	David's spurge	Euphorbiaceae
Euphorbia dentata	toothed spurge	Euphorbiaceae
Fagus grandifolia	American beech	Fagaceae
Festuca	fescue	Poaceae
Festuca subverticillata	nodding fescue	Poaceae
Fimbristylis	fimbry	Cyperaceae
Fimbristylis annua	annual fimbry	Cyperaceae
Fimbristylis puberula	hairy fimbry	Cyperaceae
Fleischmannia incarnata	pink thoroughwort	Asteraceae
Fragaria virginiana	Virginia strawberry	Rosaceae
Frangula caroliniana	Carolina buckthorn	Rhamnaceae
Fraxinus americana	white ash	Oleaceae
Fraxinus pennsylvanica	green ash	Oleaceae
Fraxinus quadrangulata	blue ash	Oleaceae
Galactia	milkpea	Fabaceae
Galactia regularis	eastern milkpea	Fabaceae
Galium aparine	stickywilly	Rubiaceae
Galium arkansanum	Arkansas bedstraw	Rubiaceae
Galium circaezans	licorice bedstraw	Rubiaceae
Galium concinnum	shining bedstraw	Rubiaceae
Galium pilosum	hairy bedstraw	Rubiaceae
Galium triflorum	fragrant bedstraw	Rubiaceae
Galium virgatum	southwestern bedstraw	Rubiaceae
Gamochaeta purpurea	spoonleaf purple everlasting	Asteraceae
Gaura	beeblossom	Onagraceae
Geranium carolinianum	Carolina geranium	Geraniaceae
Geranium maculatum	spotted geranium	Geraniaceae
Geum canadense	white avens	Rosaceae
Glandularia canadensis	rose mock vervain	Verbenaceae
Glechoma hederacea	ground ivy	Lamiaceae
Gleditsia triacanthos	honeylocust	Fabaceae
Glyceria striata	fowl mannagrass	Poaceae
Goodyera pubescens	downy rattlesnake plantain	Orchidaceae
Grindelia	gumweed	Asteraceae
Grindelia lanceolata var. *lanceolata*	narrowleaf gumweed	Asteraceae
Grindelia squarrosa	curlycup gumweed	Asteraceae
Gymnocladus dioicus	Kentucky coffeetree	Fabaceae
Gymnopogon ambiguus	bearded skeletongrass	Poaceae
Hackelia virginiana	beggarslice	Boraginaceae
Hamamelis	witchhazel	Hamamelidaceae

Scientific Name	Common Name	Family
Hamamelis vernalis	Ozark witchhazel	Hamamelidaceae
Hamamelis virginiana	American witchhazel	Hamamelidaceae
Hedeoma hispida	rough false pennyroyal	Lamiaceae
Hedyotis nigricans	diamondflowers	Rubiaceae
Helianthus	sunflower	Asteraceae
Helianthus angustifolius	swamp sunflower	Asteraceae
Helianthus divaricatus	woodland sunflower	Asteraceae
Helianthus hirsutus	hairy sunflower	Asteraceae
Helianthus silphioides	rosinweed sunflower	Asteraceae
Helianthus strumosus	paleleaf woodland sunflower	Asteraceae
Helianthus tuberosus	Jerusalem artichoke	Asteraceae
Heliopsis helianthoides	smooth oxeye	Asteraceae
Heliotropium tenellum	pasture heliotrope	Boraginaceae
Hepatica nobilis var. *acuta*	sharplobe hepatica	Ranunculaceae
Hepatica nobilis var. *obtusa*	roundlobe hepatica	Ranunculaceae
Heteranthera limosa	blue mudplantain	Pontederiaceae
Heuchera americana	American alumroot	Saxifragaceae
Heuchera americana var. *hirsuticaulis*	erican alumroot	Saxifragaceae
Heuchera villosa var. *arkansana*	Arkansas alumroot	Saxifragaceae
Hieracium gronovii	queendevil	Asteraceae
Hieracium longipilum	hairy hawkweed	Asteraceae
Houstonia longifolia	longleaf summer bluet	Rubiaceae
Houstonia purpurea	Venus' pride	Rubiaceae
Houstonia purpurea var. *calycosa*	Venus' pride	Rubiaceae
Houstonia purpurea var. *purpurea*	Venus' pride	Rubiaceae
Houstonia pusilla	tiny bluet	Rubiaceae
Hybanthus concolor	eastern greenviolet	Violaceae
Hydrangea arborescens	wild hydrangea	Hydrangeaceae
Hydrastis canadensis	goldenseal	Ranunculaceae
Hydrophyllum appendiculatum	great waterleaf	Hydrophyllaceae
Hydrophyllum virginianum	Shawnee salad	Hydrophyllaceae
Hypericum drummondii	nits and lice	Clusiaceae
Hypericum gentianoides	orangegrass	Clusiaceae
Hypericum hypericoides	St. Andrew's cross	Clusiaceae
Hypericum hypericoides ssp. *multicaule*	St. Andrew's cross	Clusiaceae
Hypericum prolificum	shrubby St. Johnswort	Clusiaceae
Hypericum pseudomaculatum	false spotted St. Johnswort	Clusiaceae
Hypericum punctatum	spotted St. Johnswort	Clusiaceae
Hypericum sphaerocarpum	roundseed St. Johnswort	Clusiaceae
Hypoxis hirsuta	common goldstar	Iridaceae
Ilex decidua	possumhaw	Aquifoliaceae
Impatiens capensis	jewelweed	Balsaminaceae
Iodanthus pinnatifidus	purplerocket	Brassicaceae
Ipomoea coccinea	redstar	Convolvulaceae
Ipomoea lacunosa	whitestar	Convolvulaceae
Ipomoea pandurata	man of the earth	Convolvulaceae
Iris cristata	dwarf crested iris	Iridaceae
Isoetes butleri	limestone quillwort	Isoetaceae

Scientific Name	Common Name	Family
Isolepis carinata	keeled bulrush	Cyperaceae
Juglans nigra	black walnut	Juglandaceae
Juncus bufonius	toad rush	Juncaceae
Juncus diffusissimus	slimpod rush	Juncaceae
Juncus interior	inland rush	Juncaceae
Juncus marginatus	grassleaf rush	Juncaceae
Juncus secundus	lopsided rush	Juncaceae
Juncus tenuis	poverty rush	Juncaceae
Juniperus ashei	Ashe's juniper	Cupressaceae
Juniperus virginiana	eastern redcedar	Cupressaceae
Justicia americana	American water-willow	Acanthaceae
Kickxia elatine	sharpleaf cancerwort	Scrophulariaceae
Krigia biflora	twoflower dwarfdandelion	Asteraceae
Krigia dandelion	potato dwarfdandelion	Asteraceae
Krigia virginica	Virginia dwarfdandelion	Asteraceae
Kummerowia stipulacea	Korean clover	Fabaceae
Kummerowia striata	Japanese clover	Fabaceae
Lactuca canadensis	Canada lettuce	Asteraceae
Lactuca floridana	woodland lettuce	Asteraceae
Lamium purpureum	purple deadnettle	Lamiaceae
Laportea canadensis	Canadian woodnettle	Urticaceae
Lappula occidentalis	flatspine stickseed	Boraginaceae
Leavenworthia uniflora	Michaux's gladecress	Brassicaceae
Lechea mucronata	hairy pinweed	Cistaceae
Lechea tenuifolia	narrowleaf pinweed	Cistaceae
Leersia	cutgrass	Poaceae
Leersia virginica	whitegrass	Poaceae
Lepidium virginicum	Virginia pepperweed	Brassicaceae
Lespedeza bicolor	shrubby lespedeza	Fabaceae
Lespedeza capitata	roundhead lespedeza	Fabaceae
Lespedeza cuneata	Chinese lespedeza	Fabaceae
Lespedeza hirta	hairy lespedeza	Fabaceae
Lespedeza procumbens	trailing lespedeza	Fabaceae
Lespedeza repens	creeping lespedeza	Fabaceae
Lespedeza stuevei	tall lespedeza	Fabaceae
Lespedeza violacea	violet lespedeza	Fabaceae
Lespedeza virginica	slender lespedeza	Fabaceae
Leucanthemum vulgare	oxeye daisy	Asteraceae
Leucospora multifida	narrowleaf paleseed	Scrophulariaceae
Liatris aspera	tall blazing star	Asteraceae
Liatris mucronata	cusp blazing star	Asteraceae
Liatris punctata	dotted blazing star	Asteraceae
Liatris squarrosa	scaly blazing star	Asteraceae
Liatris squarrosa var. *hirsuta*	scaly blazing star	Asteraceae
Ligustrum sinense	Chinese privet	Oleaceae
Limnodea arkansana	Ozark grass	Poaceae
Lindera benzoin	northern spicebush	Lauraceae
Linum berlandieri	Berlandier's yellow flax	Linaceae

Scientific Name	Common Name	Family
Linum medium var. *texanum*	stiff yellow flax	Linaceae
Linum sulcatum	grooved flax	Linaceae
Liparis liliifolia	brown widelip orchid	Orchidaceae
Liquidambar styraciflua	sweetgum	Hamamelidaceae
Lithospermum canescens	hoary puccoon	Boraginaceae
Lithospermum latifolium	American stoneseed	Boraginaceae
Lobelia cardinalis	cardinalflower	Campanulaceae
Lobelia siphilitica	great blue lobelia	Campanulaceae
Lobelia spicata	palespike lobelia	Campanulaceae
Lolium	ryegrass	Poaceae
Lolium arundinaceum	tall fescue	Poaceae
Lonicera dioica	limber honeysuckle	Caprifoliaceae
Lonicera flava	yellow honeysuckle	Caprifoliaceae
Lonicera japonica	Japanese honeysuckle	Caprifoliaceae
Lonicera sempervirens	trumpet honeysuckle	Caprifoliaceae
Ludwigia	primrose-willow	Onagraceae
Ludwigia alternifolia	seedbox	Onagraceae
Luzula acuminata	hairy woodrush	Juncaceae
Luzula bulbosa	bulbous woodrush	Juncaceae
Luzula echinata	hedgehog woodrush	Juncaceae
Maclura pomifera	osage orange	Moraceae
Magnolia acuminata	cucumber-tree	Magnoliaceae
Magnolia tripetala	umbrella-tree	Magnoliaceae
Maianthemum racemosum	feathery false lily of the vally	Liliaceae
Malaxis unifolia	green adder's-mouth orchid	Orchidaceae
Manfreda virginica	false aloe	Agavaceae
Matelea baldwyniana	Baldwin's milkvine	Asclepiadaceae
Matelea decipiens	oldfield milkvine	Asclepiadaceae
Matelea gonocarpos	angularfruit milkvine	Asclepiadaceae
Medicago lupulina	black medick	Fabaceae
Medicago minima	burr medick	Fabaceae
Melica mutica	twoflower melicgrass	Poaceae
Melica nitens	threeflower melicgrass	Poaceae
Melilotus albus	white sweetclover	Fabaceae
Melilotus officinalis	yellow sweetclover	Fabaceae
Melothria pendula	Guadeloupe cucumber	Cucurbitaceae
Menispermum canadense	common moonseed	Menispermaceae
Mentha ×piperita	peppermint	Lamiaceae
Microstegium vimineum	Nepalese browntop	Poaceae
Mimosa nuttallii	Nuttall's sensitive-briar	Fabaceae
Mimosa quadrivalvis	fourvalve mimosa	Fabaceae
Mimulus ringens	Allegheny monkeyflower	Scrophulariaceae
Minuartia patula	pitcher's stitchwort	Caryophyllaceae
Mirabilis albida	white four o'clock	Nyctaginaceae
Mollugo verticillata	green carpetweed	Molluginaceae
Monarda bradburiana	eastern beebalm	Lamiaceae
Monarda fistulosa	wild bergamot	Lamiaceae
Morus alba	white mulberry	Moraceae

Scientific Name	Common Name	Family
Morus rubra	red mulberry	Moraceae
Muhlenbergia	muhly	Poaceae
Muhlenbergia capillaris	hairawn muhly	Poaceae
Muhlenbergia sobolifera	rock muhly	Poaceae
Myosotis macrosperma	largeseed forget-me-not	Boraginaceae
Nemastylis nuttallii	Nuttall's pleatleaf	Iridaceae
Nostoc sp.		
Nothoscordum bivalve	crowpoison	Liliaceae
Nuttallanthus	toadflax	Scrophulariaceae
Nuttallanthus texanus	Texas toadflax	Scrophulariaceae
Nyssa sylvatica	blackgum	Nyssaceae
Oenothera biennis	common evening-primrose	Onagraceae
Oenothera fruticosa	narrowleaf evening-primrose	Onagraceae
Oenothera laciniata	cutleaf evening-primrose	Onagraceae
Oenothera linifolia	threadleaf evening-primrose	Onagraceae
Oldenlandia boscii	Bosc's mille graines	Rubiaceae
Oligoneuron rigidum	stiff goldenrod	Asteraceae
Onosmodium molle ssp. *subsetosum*	softhair marbleseed	Boraginaceae
Ophioglossum engelmannii	limestone adderstongue	Ophioglossaceae
Opuntia	pricklypear	Cactaceae
Opuntia humifusa	devil's-tongue	Cactaceae
Orbexilum pedunculatum	Sampson's snakeroot	Fabaceae
Osmorhiza claytonii	Clayton's sweetroot	Apiaceae
Osmorhiza longistylis	longstyle sweetroot	Apiaceae
Ostrya virginiana	Chisos hophornbeam	Betulaceae
Oxalis dillenii	slender yellow woodsorrel	Oxalidaceae
Oxalis stricta	common yellow oxalis	Oxalidaceae
Oxalis violacea	violet woodsorrel	Oxalidaceae
Oxypolis rigidior	stiff cowbane	Apiaceae
Packera aurea	golden ragwort	Asteraceae
Packera obovata	roundleaf ragwort	Asteraceae
Packera plattensis	prairie groundsel	Asteraceae
Packera tomentosa	woolly ragwort	Asteraceae
Panax quinquefolius	American ginseng	Araliaceae
Panicum anceps	beaked panicgrass	Poaceae
Panicum capillare	witchgrass	Poaceae
Panicum virgatum	switchgrass	Poaceae
Parietaria pensylvanica	Pennsylvania pellitory	Urticaceae
Parthenium	feverfew	Asteraceae
Parthenium integrifolium	wild quinine	Asteraceae
Parthenocissus quinquefolia	Virginia creeper	Vitaceae
Paspalidium	watercrown grass	Poaceae
Paspalum	crowngrass	Poaceae
Paspalum setaceum	thin paspalum	Poaceae
Passiflora incarnata	purple passionflower	Passifloraceae
Passiflora lutea	yellow passionflower	Passifloraceae
Pedicularis canadensis	Canadian lousewort	Scrophulariaceae
Pellaea atropurpurea	purple cliffbrake	Pteridaceae

Scientific Name	Common Name	Family
Pennisetum glaucum	pearl millet	Poaceae
Penstemon arkansanus	Arkansas beardtongue	Scrophulariaceae
Penstemon cobaea	cobaea beardtongue	Scrophulariaceae
Penstemon digitalis	talus slope penstemon	Scrophulariaceae
Penstemon pallidus	pale beardtongue	Scrophulariaceae
Penstemon tubiflorus	white wand beardtongue	Scrophulariaceae
Penthorum sedoides	ditch stonecrop	Crassulaceae
Perilla frutescens	beefsteakplant	Lamiaceae
Phaseolus polystachios	thicket bean	Fabaceae
Phegopteris hexagonoptera	broad beechfern	Thelypteridaceae
Philadelphus	mock orange	Hydrangeaceae
Philadelphus pubescens	hoary mock orange	Hydrangeaceae
Phlox	phlox	Polemoniaceae
Phlox divaricata	wild blue phlox	Polemoniaceae
Phlox divaricata ssp. *laphamii*	Lapham's phlox	Polemoniaceae
Phlox paniculata	fall phlox	Polemoniaceae
Phlox pilosa	downy phlox	Polemoniaceae
Phryma leptostachya	American lopseed	Verbenaceae
Phyla lanceolata	lanceleaf fogfruit	Verbenaceae
Physalis	groundcherry	Solanaceae
Physalis heterophylla	clammy groundcherry	Solanaceae
Physalis virginiana	Virginia groundcherry	Solanaceae
Physocarpus opulifolius	common ninebark	Rosaceae
Physostegia angustifolia	narrowleaf false dragonhead	Lamiaceae
Phytolacca americana	American pokeweed	Phytolaccaceae
Pilea pumila	Canadian clearweed	Urticaceae
Pinus echinata	shortleaf pine	Pinaceae
Pinus taeda	loblolly pine	Pinaceae
Piptochaetium avenaceum	blackseed speargrass	Poaceae
Plantago aristata	largebracted plantain	Plantaginaceae
Plantago lanceolata	narrowleaf plantain	Plantaginaceae
Plantago rugelii	blackseed plantain	Plantaginaceae
Plantago virginica	Virginia plantain	Plantaginaceae
Platanus occidentalis	American sycamore	Platanaceae
Pleopeltis polypodioides ssp. *michauxiana*	resurrection fern	Polypodiaceae
Poa pratensis	Kentucky bluegrass	Poaceae
Poa sylvestris	woodland bluegrass	Poaceae
Podophyllum peltatum	mayapple	Berberidaceae
Polanisia dodecandra	redwhisker clammyweed	Capparaceae
Polemonium reptans	Greek valerian	Polemoniaceae
Polygala senega	Seneca snakeroot	Polygalaceae
Polygala verticillata	whorled milkwort	Polygalaceae
Polygonatum biflorum	smooth Solomon's seal	Liliaceae
Polygonum	knotweed	Polygonaceae
Polygonum caespitosum var. *longisetum*	oriental ladysthumb	Polygonaceae
Polygonum convolvulus	black bindweed	Polygonaceae
Polygonum densiflorum	denseflower knotweed	Polygonaceae
Polygonum hydropiper	marshpepper knotweed	Polygonaceae

Scientific Name	Common Name	Family
Polygonum persicaria	spotted ladysthumb	Polygonaceae
Polygonum punctatum	dotted smartweed	Polygonaceae
Polygonum scandens	climbing false buckwheat	Polygonaceae
Polygonum tenue	pleatleaf knotweed	Polygonaceae
Polygonum virginianum	jumpseed	Polygonaceae
Polymnia canadensis	whiteflower leafcup	Asteraceae
Polypodium	polypody	Polypodiaceae
Polystichum acrostichoides	Christmas fern	Dryopteridaceae
Populus deltoides	eastern cottonwood	Salicaceae
Porteranthus stipulatus	Indian physic	Rosaceae
Potentilla	cinquefoil	Rosaceae
Potentilla canadensis	dwarf cinquefoil	Rosaceae
Potentilla recta	sulphur cinquefoil	Rosaceae
Potentilla simplex	common cinquefoil	Rosaceae
Prenanthes alba	white rattlesnakeroot	Asteraceae
Prenanthes altissima	tall rattlesnakeroot	Asteraceae
Prunella vulgaris	common selfheal	Lamiaceae
Prunus americana	American plum	Rosaceae
Prunus mexicana	Mexican plum	Rosaceae
Prunus munsoniana	wild goose plum	Rosaceae
Prunus serotina	black cherry	Rosaceae
Pseudognaphalium obtusifolium	rabbittobacco	Asteraceae
Ptelea trifoliata	common hoptree	Rutaceae
Pteridium aquilinum	western brackenfern	Dennstaedtiaceae
Pycnanthemum albescens	whiteleaf mountainmint	Lamiaceae
Pycnanthemum tenuifolium	narrowleaf mountainmint	Lamiaceae
Quercus	oak	Fagaceae
Quercus alba	white oak	Fagaceae
Quercus falcata	southern red oak	Fagaceae
Quercus macrocarpa	bur oak	Fagaceae
Quercus marilandica	blackjack oak	Fagaceae
Quercus michauxii	swamp chestnut oak	Fagaceae
Quercus muehlenbergii	chinkapin oak	Fagaceae
Quercus rubra	northern red oak	Fagaceae
Quercus shumardii	Shumard's oak	Fagaceae
Quercus stellata	post oak	Fagaceae
Quercus texana	Texas red oak	Fagaceae
Quercus velutina	black oak	Fagaceae
Ranunculus abortivus	littleleaf buttercup	Ranunculaceae
Ranunculus fascicularis	early buttercup	Ranunculaceae
Ranunculus harveyi	Harvey's buttercup	Ranunculaceae
Ranunculus hispidus	bristly buttercup	Ranunculaceae
Ranunculus hispidus var. *hispidus*	bristly buttercup	Ranunculaceae
Ranunculus recurvatus	blisterwort	Ranunculaceae
Ratibida pinnata	pinnate prairie coneflower	Asteraceae
Rhamnus	buckthorn	Rhamnaceae
Rhododendron prinophyllum	early azalea	Ericaceae
Rhus aromatica	fragrant sumac	Anacardiaceae

Scientific Name	Common Name	Family
Rhus aromatica var. *serotina*	fragrant sumac	Anacardiaceae
Rhus copallinum	flameleaf sumac	Anacardiaceae
Rhus glabra	smooth sumac	Anacardiaceae
Rhynchosia latifolia	prairie snoutbean	Fabaceae
Rhynchospora	beaksedge	Cyperaceae
Rhynchospora harveyi	Harvey's beaksedge	Cyperaceae
Rhynchospora recognita	globe beaksedge	Cyperaceae
Ribes aureum var. *villosum*	golden currant	Grossulariaceae
Ribes missouriense	Missouri gooseberry	Grossulariaceae
Robinia pseudoacacia	black locust	Fabaceae
Rorippa nasturtium-aquaticum	watercress	Brassicaceae
Rosa carolina	Carolina rose	Rosaceae
Rosa multiflora	multiflora rose	Rosaceae
Rosa setigera	climbing rose	Rosaceae
Rubus allegheniensis	Allegheny blackberry	Rosaceae
Rubus argutus	sawtooth blackberry	Rosaceae
Rubus flagellaris	northern dewberry	Rosaceae
Rubus frondosus	yankee blackberry	Rosaceae
Rubus laudatus	plains blackberry	Rosaceae
Rubus occidentalis	black raspberry	Rosaceae
Rubus ostryifolius	highbush blackberry	Rosaceae
Rubus phoenicolasius	wine raspberry	Rosaceae
Rubus roribaccus	Lucretia dewberry	Rosaceae
Rubus trivialis	southern dewberry	Rosaceae
Rudbeckia fulgida	orange coneflower	Asteraceae
Rudbeckia hirta	blackeyed Susan	Asteraceae
Rudbeckia laciniata	cutleaf coneflower	Asteraceae
Rudbeckia missouriensis	Missouri orange coneflower	Asteraceae
Rudbeckia subtomentosa	sweet coneflower	Asteraceae
Rudbeckia triloba	browneyed Susan	Asteraceae
Ruellia humilis	fringeleaf wild petunia	Acanthaceae
Ruellia pedunculata	stalked wild petunia	Acanthaceae
Ruellia strepens	limestone wild petunia	Acanthaceae
Rumex acetosella	common sheep sorrel	Polygonaceae
Rumex crispus	curly dock	Polygonaceae
Rumex obtusifolius	bitter dock	Polygonaceae
Sabatia angularis	rosepink	Gentianaceae
Saccharum alopecuroidum	silver plumegrass	Poaceae
Saccharum baldwinii	narrow plumegrass	Poaceae
Sagina decumbens	trailing pearlwort	Caryophyllaceae
Sagittaria latifolia	broadleaf arrowhead	Alismataceae
Salix caroliniana	coastal plain willow	Salicaceae
Salix nigra	black willow	Salicaceae
Salvia	sage	Lamiaceae
Salvia azurea	azure blue sage	Lamiaceae
Salvia lyrata	lyreleaf sage	Lamiaceae
Sambucus nigra ssp. *canadensis*	common elderberry	Caprifoliaceae
Samolus valerandi ssp. *parviflorus*	seaside brookweed	Primulaceae

Scientific Name	Common Name	Family
Sanguinaria canadensis	bloodroot	Papaveraceae
Sanicula	sanicle	Apiaceae
Sanicula canadensis	Canadian blacksnakeroot	Apiaceae
Sanicula odorata	clustered blacksnakeroot	Apiaceae
Sapindus saponaria var. *drummondii*	western soapberry	Sapindaceae
Saponaria officinalis	bouncingbet	Caryophyllaceae
Sassafras albidum	sassafras	Lauraceae
Saxifraga palmeri	Palmer's saxifrage	Saxifragaceae
Schizachyrium scoparium	little bluestem	Poaceae
Scirpus atrovirens	green bulrush	Cyperaceae
Scleria oligantha	littlehead nutrush	Cyperaceae
Scleria verticillata	low nutrush	Cyperaceae
Scrophularia marilandica	carpenter's square	Scrophulariaceae
Scutellaria elliptica	hairy skullcap	Lamiaceae
Scutellaria incana	hoary skullcap	Lamiaceae
Scutellaria ovata	heartleaf skullcap	Lamiaceae
Scutellaria parvula	small skullcap	Lamiaceae
Scutellaria parvula var. *missouriensis*	Leonard's skullcap	Lamiaceae
Sedum pulchellum	widowscross	Crassulaceae
Selenia aurea	golden selenia	Brassicaceae
Senecio	ragwort	Asteraceae
Senna marilandica	Maryland senna	Fabaceae
Setaria	bristlegrass	Poaceae
Setaria faberi	Japanese bristlegrass	Poaceae
Setaria parviflora	marsh bristlegrass	Poaceae
Sideroxylon lanuginosum	gum bully	Sapotaceae
Silene stellata	widowsfrill	Caryophyllaceae
Silene virginica	fire pink	Caryophyllaceae
Silphium	rosinweed	Asteraceae
Silphium asteriscus	starry rosinweed	Asteraceae
Silphium integrifolium	wholeleaf rosinweed	Asteraceae
Silphium laciniatum	compassplant	Asteraceae
Silphium perfoliatum	cup plant	Asteraceae
Silphium terebinthinaceum	prairie rosinweed	Asteraceae
Sisyrinchium angustifolium	narrowleaf blue-eyed grass	Iridaceae
Sisyrinchium campestre	prairie blue-eyed grass	Iridaceae
Sisyrinchium langloisii	roadside blue-eyed grass	Iridaceae
Smallanthus uvedalius	hairy leafcup	Asteraceae
Smilax bona-nox	saw greenbrier	Smilacaceae
Smilax ecirrata	upright carrionflower	Smilacaceae
Smilax glauca	cat greenbrier	Smilacaceae
Smilax herbacea	smooth carrionflower	Smilacaceae
Smilax lasioneura	Blue Ridge carrionflower	Smilacaceae
Smilax pulverulenta	downy carrionflower	Smilacaceae
Smilax rotundifolia	roundleaf greenbrier	Smilacaceae
Smilax tamnoides	bristly greenbrier	Smilacaceae
Solanum carolinense	Carolina horsenettle	Solanaceae
Solanum ptychanthum	West Indian nightshade	Solanaceae

Scientific Name	Common Name	Family
Solidago altissima	Canada goldenrod	Asteraceae
Solidago arguta	Atlantic goldenrod	Asteraceae
Solidago buckleyi	Buckley's goldenrod	Asteraceae
Solidago caesia	wreath goldenrod	Asteraceae
Solidago gigantea	giant goldenrod	Asteraceae
Solidago hispida	hairy goldenrod	Asteraceae
Solidago nemoralis	gray goldenrod	Asteraceae
Solidago odora	anisescented goldenrod	Asteraceae
Solidago petiolaris	downy ragged goldenrod	Asteraceae
Solidago radula	western rough goldenrod	Asteraceae
Solidago rugosa	wrinkleleaf goldenrod	Asteraceae
Solidago rugosa ssp. *aspera*	wrinkleleaf goldenrod	Asteraceae
Solidago ulmifolia	elmleaf goldenrod	Asteraceae
Solidago ulmifolia var. *palmeri*	Palmer's goldenrod	Asteraceae
Solidago ulmifolia var. *ulmifolia*	elmleaf goldenrod	Asteraceae
Sorghastrum nutans	Indiangrass	Poaceae
Sorghum halepense	Johnsongrass	Poaceae
Sphenopholis obtusata	prairie wedgescale	Poaceae
Spigelia marilandica	woodland pinkroot	Loganiaceae
Spiranthes ovalis	October lady's tresses	Orchidaceae
Spirodela polyrrhiza	common duckmeat	Lemnaceae
Sporobolus	dropseed	Poaceae
Sporobolus clandestinus	rough dropseed	Poaceae
Sporobolus vaginiflorus var. *ozarkanus*	Ozark dropseed	Poaceae
Stachys	hedgenettle	Lamiaceae
Staphylea trifolia	American bladdernut	Staphyleaceae
Stellaria media	common chickweed	Caryophyllaceae
Stellaria pubera	star chickweed	Caryophyllaceae
Strophostyles helvula	trailing fuzzybean	Fabaceae
Strophostyles umbellata	pink fuzzybean	Fabaceae
Stylophorum diphyllum	celandine poppy	Papaveraceae
Stylosanthes biflora	sidebeak pencilflower	Fabaceae
Symphoricarpos orbiculatus	coralberry	Caprifoliaceae
Symphyotrichum	aster	Asteraceae
Symphyotrichum anomalum	manyray aster	Asteraceae
Symphyotrichum drummondii	Drummond's aster	Asteraceae
Symphyotrichum laeve	smooth blue aster	Asteraceae
Symphyotrichum lanceolatum	white panicle aster	Asteraceae
Symphyotrichum lateriflorum	calico aster	Asteraceae
Symphyotrichum oblongifolium	aromatic aster	Asteraceae
Symphyotrichum patens	late purple aster	Asteraceae
Symphyotrichum pilosum	hairy white oldfield aster	Asteraceae
Symphyotrichum sericeum	western silver aster	Asteraceae
Symphyotrichum shortii	Short's aster	Asteraceae
Taenidia integerrima	yellow pimpernel	Apiaceae
Talinum	fameflower	Portulacaceae
Taraxacum officinale	common dandelion	Asteraceae
Tephrosia virginiana	Virginia tephrosia	Fabaceae

Scientific Name	Common Name	Family
Teucrium canadense	Canada germander	Lamiaceae
Thalictrum dioicum	early meadow-rue	Ranunculaceae
Thalictrum revolutum	waxyleaf meadow-rue	Ranunculaceae
Thalictrum thalictroides	rue anemone	Ranunculaceae
Thaspium barbinode	hairyjoint meadowparsnip	Apiaceae
Thaspium trifoliatum	purple meadowparsnip	Apiaceae
Tilia americana	American basswood	Tiliaceae
Torilis arvensis	spreading hedgeparsley	Apiaceae
Toxicodendron pubescens	Atlantic poison oak	Anacardiaceae
Toxicodendron radicans	eastern poison ivy	Anacardiaceae
Tradescantia ohiensis	bluejacket	Commelinaceae
Tradescantia ozarkana	Ozark spiderwort	Commelinaceae
Tragia cordata	heartleaf noseburn	Euphorbiaceae
Tragia ramosa	branched noseburn	Euphorbiaceae
Tragia urticifolia	nettleleaf noseburn	Euphorbiaceae
Trichostema dichotomum	forked bluecurls	Lamiaceae
Tridens flavus	purpletop tridens	Poaceae
Tridens flavus var. *chapmanii*	Chapman's tridens	Poaceae
Tridens flavus var. *flavus*	purpletop tridens	Poaceae
Trifolium campestre	field clover	Fabaceae
Trifolium dubium	suckling clover	Fabaceae
Trifolium pratense	red clover	Fabaceae
Trifolium repens	white clover	Fabaceae
Trillium pusillum var. *ozarkanum*	Ozark wakerobin	Liliaceae
Trillium recurvatum	bloody butcher	Liliaceae
Trillium sessile	toadshade	Liliaceae
Trillium viride	wood wakerobin	Liliaceae
Trillium viridescens	tapertip wakerobin	Liliaceae
Triodanis perfoliata	clasping Venus' looking-glass	Campanulaceae
Triosteum angustifolium	yellowfruit horse-gentian	Caprifoliaceae
Triosteum perfoliatum	feverwort	Caprifoliaceae
Tripsacum dactyloides	eastern gamagrass	Poaceae
Typha latifolia	broadleaf cattail	Typhaceae
Ulmus	elm	Ulmaceae
Ulmus alata	winged elm	Ulmaceae
Ulmus americana	American elm	Ulmaceae
Ulmus rubra	slippery elm	Ulmaceae
Urtica chamaedryoides	heartleaf nettle	Urticaceae
Urtica dioica	stinging nettle	Urticaceae
Uvularia grandiflora	largeflower bellwort	Liliaceae
Vaccinium arboreum	farkleberry	Ericaceae
Vaccinium pallidum	Blue Ridge blueberry	Ericaceae
Vaccinium stamineum	deerberry	Ericaceae
Valerianella radiata	beaked cornsalad	Valerianaceae
Verbascum thapsus	common mullein	Scrophulariaceae
Verbena hastata	swamp verbena	Verbenaceae
Verbena urticifolia	white vervain	Verbenaceae
Verbesina alternifolia	wingstem	Asteraceae

Scientific Name	Common Name	Family
Verbesina helianthoides	gravelweed	Asteraceae
Verbesina virginica	white crownbeard	Asteraceae
Vernonia	ironweed	Asteraceae
Vernonia arkansana	Arkansas ironweed	Asteraceae
Vernonia baldwinii	Baldwin's ironweed	Asteraceae
Viburnum dentatum	southern arrowwood	Caprifoliaceae
Viburnum molle	softleaf arrowwood	Caprifoliaceae
Viburnum prunifolium	blackhaw	Caprifoliaceae
Viburnum rufidulum	rusty blackhaw	Caprifoliaceae
Vicia	vetch	Fabaceae
Vicia caroliniana	Carolina vetch	Fabaceae
Vicia minutiflora	pygmyflower vetch	Fabaceae
Vicia sativa	garden vetch	Fabaceae
Viola	violet	Violaceae
Viola bicolor	field pansy	Violaceae
Viola palmata	early blue violet	Violaceae
Viola pedata	birdfoot violet	Violaceae
Viola pubescens	downy yellow violet	Violaceae
Viola sororia	common blue violet	Violaceae
Viola striata	striped cream violet	Violaceae
Viola villosa	Carolina violet	Violaceae
Vitis aestivalis	summer grape	Vitaceae
Vitis cinerea	graybark grape	Vitaceae
Vitis palmata	catbird grape	Vitaceae
Vitis riparia	riverbank grape	Vitaceae
Vitis rotundifolia	muscadine	Vitaceae
Vitis vulpina	frost grape	Vitaceae
Vulpia myuros	rat-tail fescue	Poaceae
Woodsia obtusa	bluntlobe cliff fern	Dryopteridaceae
Xanthium strumarium	rough cockleburr	Asteraceae
Yucca arkansana	Arkansas yucca	Agavaceae
Zizia aurea	golden zizia	Apiaceae

Appendix E: Map Verification Table

Brief Explanation of the Map Verification Table

Map verification of preliminary mapping was performed throughout the Buffalo National River (BUFF) at three locations with diverse vegetation types. These locations included the following: Boxley Valley, Tyler Bend, and the area around Toney Bend. The purpose of map verification for the BUFF vegetation mapping project was to test the map classification and conventions, as well as the environmental models. Results from the field testing gave weight to whether mapping conventions and/or environmental models would need adjusting prior to the mapping effort. The field effort for the map verification occurred from September 21 to October 2, 2009.

A team of mappers and classifiers collected coordinate location information by using global positioning system (GPS) devices, as well as environmental gradient data, including: aspect, slope, topographic position, slope curvature, solar radiation, geology, soil type, soil pH, and general comments regarding the site. The key (the then current 2009 version) to the vegetation types of the BUFF was used to determine the vegetation type of the area. The vegetation type was compared to the map class assigned by the mapper. A total of 34 sites were visited for map verification.

Table E-1 provides the map classes and map-class names that were current at the time of map verification in 2009. Note that some map classes have changed since the time of the map verification. Also realize that not all map classes for the mapping project at that time are listed in the table; only the ones that were recognized from the map verification effort are listed.

Table E-1. Map classes and map-class names used at the time of map verification in 2009.

Map Class	Map Class Name
FBH	Ozark Rich Beech - Mixed Hardwood Forest
FCH	Ozark Red-cedar - Hardwood Forest/Woodland
FDX	Early-Successional Hardwood Forest
FOA	Dry-Mesic Oak - Hickory Acidic Forest
FOC	Dry-Mesic Oak - Hickory Calcareous Forest
FOD	Dry Oak - Hickory Forest
FOM	Mesic Oak - Hardwood Forest
FPB	Interior Highlands Shortleaf Pine - Black Oak Forest
FPO	Dry-mesic Pine - Oak Forest
FRC	Eastern Red-cedar Successional Forest
FSC	Southern Interior Box-elder Riparian Forest
FSG	Ouachita-Ozark Small Stream Hardwood Forest
HCG	Dolomite - Limestone Glade
WAJ	Ozark Ashe's Juniper Glade Woodland
WCO	Chinquapin Oak - Ash / Little Bluestem Woodland
WOD	Dry Post Oak - Blackjack Oak Woodland

Table E-2 shows the baseline data collected at each map verification site. This table was originally constructed by staff from the U.S. Geological Survey Mid-Continent Geographic Science Center. Modifications have been made for formatting purposes and to fill in or clarify some of the data.

A feature-class layer showing locations of the map verification sites (field data and map-class names included) has been produced and incorporated into the geodatabase for the BUFF vegetation mapping project.

Table E-2. Map verification sites and associated data collected at each site.

Vrf Site	UTM Easting	UTM Northing	Map Call*	Field Call*	Aspect Degree	Slope	Topographic Position	Curvature Planimetric	Curvature Profile	Solar Radiation	Geology	Soil Type	Soil pH	Comments
1	464368	3977882	FBH	FBH	20	steep	mid slope	slightly convex	flat	5	Boone	Enders stony loam	4.6	None
2	464340	3977803	FRC	FCH	30	gentle	upper slope	moderately convex	moderately convex	15	Fayetteville Shale	Enders stony loam	4.6	Vegetation key will be adjusted.
3	464267	3977872	FBH	FOA	320	gentle	upper slope	moderately concave	slightly concave	12	Boone	Enders stony loam	4.6	None
4	464187	3977856	FBH	FOA	320	moderate	upper slope	slightly convex	flat	13	Boone	Noark very cherty silt loam	5.5	Less than 25% Beech. Tom Foti does not like the solar radiation value at this point.
5	463968	3977917	FBH	FOM	310	moderate	lower (toe) slope	flat	slightly concave	12	Boone	Noark very cherty silt loam	5.5	Assessed area upslope to Southeast from these coordinates.
6	464016	3977858	FCH	FDX	50	moderate	upper slope	flat	slightly convex	15	Boone	Noark very cherty silt loam	5.5	None
7	463832	3977672	FOC	FBH	0	gentle	bottom	strongly concave	slightly concave	7	Boone	Arkana-Moko complex	7.2	Assessed area to south from these coordinates.
8	464670	3977405	FOC	FOM	350	gentle	bench	flat	flat	11	Pitkin Limestone	Eden-Newnata complex	6.5	[altered oak-hardwood forest]
9	464671	3977374	FOC	FBH	0	steep	mid slope	flat	strongly concave	12	Pitkin Limestone	Eden-Newnata complex	6.5	In a narrow band below a rock outcrop. [altered oak-hardwood forest]
10	462427	3977987	N/A	WOD	170	very steep	upper slope	flat	flat	17	Bloyd	Nella-Steprock-Mountainberg very stony loams	5.0	Vegetation key assessment says, "WOD (WWP)."
11	465233	3979715	FOM	FOM	0	moderate	mid slope	slightly concave	flat	10	Fayetteville Shale	Eden-Newnata complex	6.5	Area is missing oaks. [altered oak-hardwood forest]
12	465630	3980217	FBH	FBH	0	moderate	mid slope	strongly concave	moderately concave	14	Boone	Arkana-Moko complex	7.2	None

Vrf Site	UTM Easting	UTM Northing	Map Call*	Field Call*	Aspect Degree	Slope	Topographic Position	Curvature Planimetric	Curvature Profile	Solar Radiation	Geology	Soil Type	Soil pH	Comments
13	538846	3998756	WAJ	WAJ	200	moderate	mid slope	slightly convex	flat	17	Everton	Estate-Portia-Moko association	6.2	None
14	N/A	N/A	WOD	WCO	250	moderate	mid slope	flat	flat	16	Everton	Estate-Portia-Moko association	6.2	[coordinates unknown]
15	538912	3999009	WOD	WOD	220	moderately steep	mid slope	flat	flat	17	St. Peter Sandstone	Estate-Portia-Moko association	6.2	None
16	538995	3999048	WOD	WOD	190	steep	upper slope	slightly convex	slightly convex	18	Boone	Clarksville very cherty silt loam	5.3	None
17	539005	3999063	FOD	FOD	230	gentle	ridgetop	flat	slightly convex	18	Boone	Clarksville very cherty silt loam	5.3	None
18	538551	3993175	N/A	FPO	270	gentle	upper slope	slightly convex	slightly convex	N/A	Boone	Nixa very cherty silt loam	5.0	None
19	538507	3993294	N/A	FPB	260	moderate	upper slope	slightly convex	slightly convex	N/A	Boone	Clarksville very cherty silt loam	5.3	Vegetation key assessment says, "FPB - marginal, inclusion." Point is very close to Soil = Nixa very cherty silt loam, pH 5.0, upslope to East.
20	538331	3993445	N/A	FOM	260	very steep	lower slope	slightly convex	slightly convex	N/A	Middle Ordovician	Clarksville very cherty silt loam	5.3	Point is on slope above the creek bottom to West. Tom Foti disagrees with the soil type.
21	542431	3995594	WCO	WCO	240	very steep	upper slope	flat	strongly convex	15	Plattin Limestone	Moko-Rock outcrop complex	7.2	Solar radiation = 13 down slope from point.
22	542445	3995606	FOD	FOD	260	steep	upper slope	flat	slightly concave	16	Plattin Limestone	Moko-Rock outcrop complex	7.2	None
23	542413	3995842	FOD	FOA	20	gentle	upper slope/ ridgetop	flat	slightly convex	16	Boone	Nixa very cherty silt loam	5.0	None

Vrf Site	UTM Easting	UTM Northing	Map Call*	Field Call*	Aspect Degree	Slope	Topographic Position	Curvature Planimetric	Curvature Profile	Solar Radiation	Geology	Soil Type	Soil pH	Comments
24	541963	3995983	HCG	HCG	190	very steep	upper slope	slightly concave	flat	7	Boone	Moko-Rock outcrop complex	7.2	Beautiful steep glade. My notes say "WCG" but I don't see that listed anywhere. [changed to likely intent of HCG map code]
25	541920	3996014	FOD	FOD	220	moderate	upper slope/ ridgetop	slightly convex	slightly convex	17	Boone	Moko-Rock outcrop complex	7.2	Point is very close to Soil = Nixa very cherty silt loam, pH 5.0, upslope to North.
26	520691	3981376	FOA	FOA	260	gentle	small ridgetop	slightly concave	slightly convex	16	Boone	Noark very cherty silt loam	5.5	None
27	520779	3981690	FSG	FSG	10	gentle	bottom	strongly concave	flat	16	Boone	Arkana-Moko complex	6.5	None
28	520947	3981920	WAJ	WAJ	260	steep	mid to lower slope	slightly convex	slightly convex	14	Boone	Arkana-Moko complex	6.5	None
29	521002	3981930	FOC	FOA	270	steep	upper slope	flat	slightly convex	13	Boone	Arkana-Moko complex	6.5	None
30	521294	3981445	FOD	FOA	350	gentle	upper slope	moderately convex	flat	15	Boone	Noark very cherty silt loam	5.5	None
31	521660	3981569	FSG	FOM	40	gentle	lower (toe) slope	flat	slightly concave	4	Boone	Clarksville very cherty silt loam	4.8	None
32	521543	3981760	FSC	FSG	40	gentle	bottom	flat	flat	10	Boone	Clarksville very cherty silt loam	4.8	None
33	521502	3981729	FOM	FOM	350	moderate	lower slope	slightly convex	flat	8	Boone	Clarksville very cherty silt loam	4.8	Vegetation assessment says, "FOM - narrow strip."
34	521632	3982151	FSC	FSC	30	gentle	bottom	slightly concave	flat	16	Boone	Clarksville very cherty silt loam	4.8	Point is very close to Soil = Healing silt loam, pH 6.1, down in drain to East. Vegetation key assessment says, "Key needs some work."

*Map-class codes are based on codes that were developed at the time of map verification. Many of these codes have been changed since the map verification, mostly as a result of the merging of map classes because of low individual accuracy results (via the accuracy assessment study).

Appendix F: Descriptions of Map Classes

Explanation of Map-class Descriptions

This appendix to the Main Report of the Buffalo National River (BUFF) vegetation mapping project provides descriptions of the 29 map classes we used to map the BUFF for the National Park Service (NPS) Vegetation Inventory Program (VIP). Of these 29 map classes, 26 represent natural/semi-natural vegetation types in the National Vegetation Classification Standard (NVCS), Version 2 (FGDC 2008), one map classes represents cultural vegetation (e.g., developed lands) in the NVCS, and two map classes represent non-vegetation features (e.g., open-water bodies). For those map classes representing vegetation associations in the NVCS, we recommend using Appendix B: Descriptions of Vegetation Types and Appendix C: Field Key to Vegetation Types to complement the map-class descriptions in this appendix.

Each map-class description provides the formal map-class code and name we used for mapping. For map classes that represent just one association type in the NVCS, the common name provided by NatureServe is used as the map-class name. For map classes that represent more than one association type, a vegetation type above the association level in the NVCS (e.g., group level), or a non-vegetation feature (e.g., open-water bodies), we devised succinct names to describe the feature.

At the commencement of each map-class description, we provide the official classification name and code that the map class represents in the NVCS; however for non-vegetation map classes, we provide the classification given in the 2001 version of the National Land Cover Database (NLCD) (Homer et al. 2004). Each map class is described with a focus on BUFF lands and not necessarily on the region beyond. Also, descriptions are from a mapping, rather than an ecologic, perspective. But some ecologic concepts are inherent to the descriptions, as one would expect when describing the mapping of types in the NVCS.

Throughout the map-class descriptions, “RD” refers to relative density, and “AA” refers to accuracy assessment. Hardwood trees refer to all deciduous tree species. Also, all tree species (e.g., northern red oak, shortleaf pine, American sycamore) are to be assumed to be of heights >5 m, unless otherwise specified (e.g., shrub-height trees) in the description. The term “tree species” in this assumption includes general references to trees as conifers and hardwoods. Furthermore, unless otherwise noted, the herbaceous types have <25% total tree and shrub canopy closure. Shrubland types have >25% shrub canopy closure, and <25% tree canopy closure. Forests and woodlands have >25% tree canopy closure.

Some reference is made to general or specific locations within the BUFF to help describe where map classes were applied. Figure F-1 is provided to assist in those location references.

Along with describing the map classes via text, ground pictures are provided to give visual depictions of the vegetation types and non-vegetation features that the map classes represent. It is worth noting that the pictures are a partial representation; to capture all variations within a map class would be daunting.

We had attempted to organize the map classes that represent vegetation types according to the hierarchy in the NVCS. Several map classes, however, represent multiple vegetation associations and made hierarchical organization problematic; the individual vegetation types were not contained within the same hierarchical location in the NVCS. Thus, we organized the map

classes in an ad-hoc classification system that organizes and groups map classes primarily by physiognomic and/or hydrologic regimes. We organized map classes that represent non-vegetation features (e.g., open water) by using the classification in the NLCD. Map classification codes, names, and their crosswalk to the NVCS and the NLCD are listed in Table F-1. Table F-2 shows the map classification set within the official hierarchy of the NVCS. In Table F-2, map classes that represent more than one vegetation type are noted with an asterisk (*); keep in mind that these map classes may represent vegetation types in more than one location in the NVCS hierarchy. The map classification is listed alphabetically by map-class code in Table F-3 at the end of this appendix.

Minimum Mapping Units

We generally applied the NPS VIP standard minimum mapping unit (MMU) of 0.5 ha for mapping. For select map classes, we applied a MMU of 0.25 ha to address management preferences; these map classes are noted in Table F-1. Also, when vegetation types were found unique to their immediate surroundings (e.g., rocky open-canopy pine woodland within a closed-canopy oak forest), we allowed for mapping below the MMU.

No Map Class

There were four vegetation associations in the NVCS that were not defined by any one map class. These associations were found to always be well below the MMU. The four associations are listed below:

- (*Carex interior*, *Carex lurida*) - *Carex leptalea* - *Parnassia grandifolia* - *Rhynchospora capillacea* Herbaceous Vegetation (CEGL002404)
- *Justicia americana* Herbaceous Vegetation (CEGL004286)
- Limestone - Dolostone Talus Sparse Vegetation (CEGL002308)
- Sandstone Interior Highlands Talus Sparse Vegetation (CEGL002309)

As with those associations represented by the various map classes described in this appendix, these four associations are described in Appendix B: Descriptions of Vegetation Types. They are also included in Appendix C: Field Key to Vegetation Types.

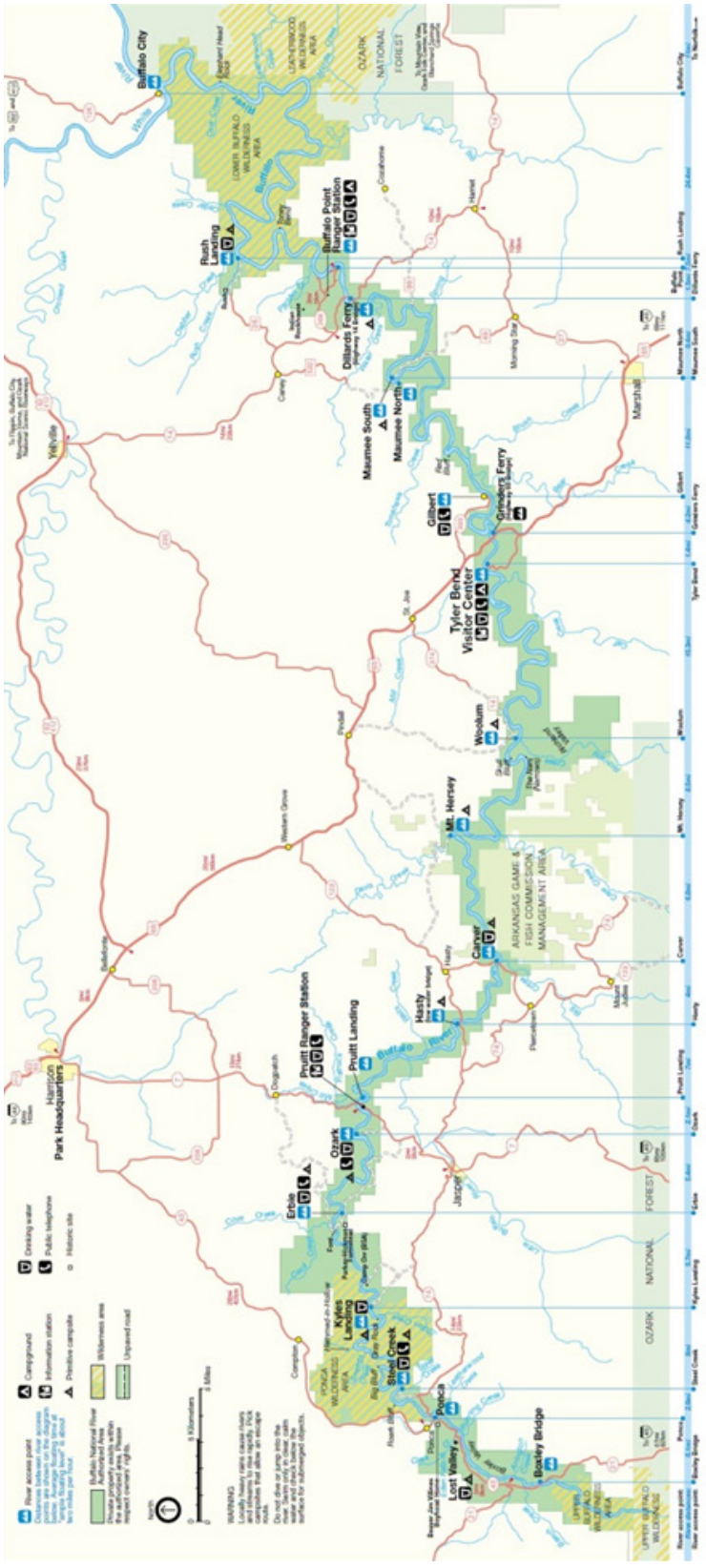


Figure F-1. Buffalo National River, Arkansas (courtesy nps.gov).

Table F-1. Map Classification and crosswalk to vegetation types in the National Vegetation Classification Standard, Version 2 (FGDC 2008), for the Buffalo National River (Arkansas) vegetation mapping project.

Note: the bold headings within the table (above the map classes) are primarily ad-hoc physiognomic and/or hydrologic categories to help organize the map classes; this category system is an ad-hoc arrangement and not part of any recognized classification hierarchy; however, all map classes except for those under the Open Water category represent vegetation types within the National Vegetation Classification Standard.
[CEGL, Community Element Global; NLCD, National Land Cover Database; NVCS, National Vegetation Classification Standard]

Map Class Code - Name	Vegetation Association* Common Name	Vegetation Association* Scientific Name	CEGL Code*
Conifer Forest			
FSP - Shortleaf Pine Forest			
	Early-Successional Shortleaf Pine Forest	*Pinus echinata* Early-Successional Forest	CEGL006327
	Interior Highlands Shortleaf Pine / Blueberry Forest	*Pinus echinata* / *Vaccinium* (*arboreum*, *pallidum*, *stamineum*) Forest	CEGL002400
Conifer - Hardwood Forest			
FPO - Shortleaf Pine - Oak Forest			
	Interior Highlands Shortleaf Pine - Oak Dry-Mesic Forest	*Pinus echinata* - *Quercus* (*alba, rubra*) / *Vaccinium* (*arboreum*, *pallidum*) / *Schizachyrium scoparium* - *Chasmanthium sessiliflorum* - *Solidago ulmifolia* Forest	CEGL007489
	Interior Highlands Shortleaf Pine - Black Oak Forest	*Pinus echinata* - *Quercus velutina* - *Quercus stellata* / *Vaccinium* spp. Forest	CEGL002401
FCH - Ozark Red-cedar - Hardwood Forest			
	Ozark Red-cedar - Hardwood Forest	*Juniperus virginiana* - *Quercus* (*alba*, *stellata*) - *Carya texana* Forest	CEGL004803
Oak - (Hardwood) Forest			
FDO - Mixed Oak - (Hardwood) Dry Forest			
	Black Oak - White Oak - Hickory Forest	*Quercus velutina* - *Quercus alba* - *Carya* (*glabra*, *ovata*) Forest	CEGL002076
	Chinquapin Oak - Shumard Oak Ozark Forest	*Quercus muehlenbergii* - *Quercus shumardii* Forest	CEGL004602
	White Oak - Red Oak Dry-Mesic Acidic Forest	*Quercus alba* - *Quercus rubra* - *Carya* (*alba*, *ovata*) / *Cornus florida* Acidic Forest	CEGL002067
	White Oak - Mixed Oak Dry-Mesic Alkaline Forest	*Quercus alba* - *Quercus rubra* - *Quercus muehlenbergii* / *Cercis canadensis* Forest	CEGL002070
	Ozark-Ouachita Dry-Mesic - White Oak - Black Oak - Hickory Forest	*Quercus alba* - *Quercus velutina* - *Carya alba* / *Desmodium nudiflorum* Ozark Forest	CEGL004270
	Eastern Oklahoma Dry-Mesic Oak - Hickory Forest	*Quercus falcata* - *Carya alba* - *Carya ovata* Forest	CEGL004543
	Midwest Post Oak - Blackjack Oak Forest	*Quercus stellata* - *Quercus marilandica* - *Carya* (*glabra*, *texana*) / *Vaccinium arboreum* Forest	CEGL002075

Map Class Code - Name	Vegetation Association* Common Name	Vegetation Association* Scientific Name	CEGL Code*
Mesic Hardwood Forest			
FBH - Ozark Rich Beech - Mixed Hardwood Forest			
	Ozark Rich Beech - Mixed Hardwood Forest	*Fagus grandifolia* - *Quercus rubra* - *Tilia americana* var. *caroliniana* / *Magnolia tripetala* / *Podophyllum peltatum* Forest	CEGL007823
FOM - White Oak - Red Oak - Sugar Maple Mesic Forest			
	White Oak - Red Oak - Sugar Maple Mesic Forest	*Quercus alba* - *Quercus rubra* - *Acer saccharum* - *Carya cordiformis* / *Lindera benzoin* Forest	CEGL002058
Successional Forest			
FPP - Pine Plantation Forest			
	Shortleaf Pine Plantation	*Pinus echinata* Planted Forest	CEGL007169
	Loblolly Pine Plantation	*Pinus taeda* Planted Forest	CEGL007179
FRS - Ruderal Eastern Red-cedar - (Pine) Forest			
	Successional Eastern Red-cedar Forest	*Juniperus virginiana* var. *virginiana* - (*Quercus* spp.) Forest	CEGL007124
	Red-cedar - Pine - Elm Successional Ozark Forest	*Juniperus virginiana* var. *virginiana* - *Pinus echinata* - *Ulmus alata* / *Rhus glabra* Forest	CEGL007816
FDX - Ruderal Hardwood Forest			
	Interior Mid- to Late-Successional Sweetgum - Oak Forest	*Liquidambar styraciflua* - *Quercus* (*alba*, *falcata*) Forest	CEGL007217
	Osage-orange Successional Forest	*Maclura pomifera* Semi-natural Forest	CEGL006627
	Ozark Honey-locust - Black Walnut Woodland	*Gleditsia triacanthos* - *Juglans nigra* / *Bromus secalinus* - *Poa pratensis* Successional Woodland	CEGL004345
	Successional Black Locust Forest	*Robinia pseudoacacia* Forest	CEGL007279
Bottomland Hardwood Forest			
FRH - Riparian Hardwood Forest			
	Southern Interior Box-elder Riparian Forest	*Acer negundo* - (*Platanus occidentalis*, *Populus deltoides*) Forest	CEGL004690
	Silver Maple - Elm Forest	*Acer saccharinum* - *Ulmus americana* Forest	CEGL002586
	River Birch - Sycamore Small River Floodplain Forest	*Betula nigra* - *Platanus occidentalis* Forest	CEGL002086
	Ash - Oak - Sycamore Mesic Bottomland Forest	*Fraxinus pennsylvanica* - *Celtis* spp. - *Quercus* spp. - *Platanus occidentalis* Bottomland Forest	CEGL002410
	Southern Green Ash - Elm - Sugarberry Forest	*Fraxinus pennsylvanica* - *Ulmus americana* - *Celtis laevigata* / *Ilex decidua* Forest	CEGL002427
	Ouachita-Ozark Small Stream Hardwood Forest	*Liquidambar styraciflua* - (*Quercus alba*, *Acer saccharum*) / *Carpinus caroliniana* / *Lindera benzoin* Forest	CEGL007826
	Bur Oak - Shumard Oak Mixed Bottomland Forest	*Quercus macrocarpa* - *Quercus shumardii* - *Carya cordiformis* / *Chasmanthium latifolium* Forest	CEGL004544

Map Class Code - Name	Vegetation Association* Common Name	Vegetation Association* Scientific Name	CEGL Code*
FBF - Box-elder Floodplain Forest			
	Box-elder Floodplain Forest	*Acer negundo* Forest	CEGL005033
Conifer Woodland			
WAJ - Ozark Ashe's Juniper Woodland**			
	Ozark Ashe's Juniper Glade Woodland	*Juniperus ashei* / *Cotinus obovatus* / *Carex eburnea* - *Rudbeckia missouriensis* Woodland	CEGL007833
	Ozark Ashe's Juniper Clifftop Woodland	*Juniperus ashei* Ozark Clifftop Woodland	CEGL004672
WRC - Red-cedar Alkaline Bluff Woodland**			
	Red-cedar Alkaline Bluff Woodland	*Juniperus virginiana* Alkaline Bluff Woodland	CEGL002426
Conifer - Hardwood Woodland			
WPO - Ozark/Ouachita Shortleaf Pine - Oak Dry Woodland			
	Ozark/Ouachita Shortleaf Pine - Oak Dry Woodland	*Pinus echinata* - *Quercus stellata* - *Quercus marilandica* / *Schizachyrium scoparium* Woodland	CEGL002393
Oak - (Hardwood) Woodland			
WCO - Chinquapin Oak - Ash / Little Bluestem Woodland			
	Chinkapin Oak - Ash / Little Bluestem Woodland	*Quercus muehlenbergii* - *Fraxinus* (*quadrangulata*, *americana*) / *Schizachyrium scoparium* Woodland	CEGL002143
WOD - Mixed Oak Dry Woodland			
	White Oak - Post Oak / Bluestem Ozark Woodland	*Quercus alba* - *Quercus stellata* - *Quercus velutina* / *Schizachyrium scoparium* Woodland	CEGL002150
	Blackjack Oak Xeric Scrub	*Quercus marilandica* / *Vaccinium arboreum* / *Danthonia spicata* Scrub Woodland	CEGL002425
	Ozark/Ouachita Post Oak - Blackjack Oak / Little Bluestem Woodland	*Quercus stellata* - *Quercus marilandica* - *Quercus velutina* - *Carya texana* / *Schizachyrium scoparium* Woodland	CEGL002149
Successional Shrubland			
SMX - Ruderal Shrubland			
	Southeastern Old Field Group	Southeastern Old Field Group	G583
Bottomland Shrubland			
SCB - Floodplain Canebrake**			
	Floodplain Canebrake	*Arundinaria gigantea* ssp. *gigantea* Shrubland	CEGL003836
SHA - Interior Alder Shrubland			
	Interior Alder Shrubland	*Alnus serrulata* Interior Shrubland	CEGL003894
SGB - Riverine Gravel Bar Shrubland**			
	Witch-hazel - Dogwood Gravel Wash	*Hamamelis vernalis* - *Cornus obliqua* - *Hypericum prolificum* Shrubland	CEGL003898
	Carolina Willow Ozark Shrubland	*Salix caroliniana* Temporarily Flooded Ozark Shrubland	CEGL007064

Map Class Code - Name	Vegetation Association* Common Name	Vegetation Association* Scientific Name	CEGL Code*
Herbaceous Glade			
HSG - Ozark Sandstone Glade**			
	Ozark Sandstone Glade	*Schizachyrium scoparium* - *Aristida dichotoma* - *Croton willdenowii* / Lichens Wooded Herbaceous Vegetation	CEGL002242
HCG - Herbaceous Calcareous Glade**			
	Ozark Basic Sandstone Glade	*Quercus stellata* - (*Pinus echinata*) / *Vaccinium arboreum* / *Andropogon gerardii* - *Symphyotrichum patens* var. *patentissimum* Wooded Herbaceous Vegetation	CEGL007814
	Ozark Limestone Glade	*Schizachyrium scoparium* - *Bouteloua curtipendula* - *Rudbeckia missouriensis* - *Mentzelia oligosperma* Wooded Herbaceous Vegetation	CEGL002251
	Ozark Dolomite Glade	*Schizachyrium scoparium* - *Sorghastrum nutans* - *Bouteloua curtipendula* - *Rudbeckia missouriensis* - *Hedyotis nigricans* Wooded Herbaceous Vegetation	CEGL002398
Herbaceous Field			
HMX - Ruderal Herbaceous Field			
	Successional Broomsedge Vegetation	*Andropogon virginicus* var. *virginicus* Herbaceous Vegetation	CEGL004044
	Cultivated Meadow	*Lolium* (*arundinaceum*, *pratense*) Herbaceous Vegetation	CEGL004048
Herbaceous Wetland			
HMM - Herbaceous Marsh & Wet Meadow			
	Southeastern Ruderal Wet Meadow & Marsh Group	Southeastern Ruderal Wet Meadow & Marsh Group	G557
	Bulrush - Cattail - Bur-reed Shallow Marsh	*Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation	CEGL002026
	Southern Cattail Marsh	*Typha latifolia* Southern Herbaceous Vegetation	CEGL004150
HFA - Watershield Pond			
	Watershield Pond	*Brasenia schreberi* Eastern Herbaceous Vegetation	CEGL004527
Gravel Bar Sparse Vegetation			
VRG - Ozark Riverine Gravel Flats**			
	Ozark Riverine Gravel Flats	Ozark Riverine Cobble - Gravel Flats Sparse Vegetation	CEGL007012
Cultural			
CDV - Developed Area			CEGLNLCD21 CEGLNLCD22 CEGLNLCD23 CEGLNLCD24

Map Class Code - Name	Vegetation Association* Common Name	Vegetation Association* Scientific Name	CEGL Code*
Open Water (Non-NVCS)			
NSR - Stream & River			CEGLNLCD11
NWP - Open Water Pond			CEGLNLCD11

*Unless otherwise noted.
**A minimum mapping unit of 0.25 ha was applied to these map classes during mapping.

Table F-2. Map classification set into the hierarchy of the National Vegetation Classification Standard, Version 2 (FGDC 2008), for the Buffalo National River (Arkansas) vegetation mapping project.

[CEGL, Community Global Element; NVCS, National Vegetation Classification Standard; NLCD, National Land Cover Database]

Map-class Code	Map-class Name
1. FOREST TO OPEN WOODLAND CLASS	
1.B.1.Na. Southeastern North American Warm Temperate Forest Division	
M305. Southeastern North American Ruderal Forest & Plantation Macrogroup	
G029. Southeast Conifer & Hardwood Plantation Group	
Pinus echinata Planted Forest Association (CEGL007169)	
FPP*	Pine Plantation Forest
Pinus taeda Planted Forest Association (CEGL007179)	
FPP*	Pine Plantation Forest
G031. Southeast Hardwood & Conifer Ruderal Forest Group	
Juniperus virginiana var. *virginiana* - (*Quercus* spp.) Forest Association (CEGL007124)	
FRS*	Ruderal Eastern Red-cedar - (Pine) Forest
Juniperus virginiana var. *virginiana* - *Pinus echinata* - *Ulmus alata* / *Rhus glabra* Forest Association (CEGL007816)	
FRS*	Ruderal Eastern Red-cedar - (Pine) Forest
Liquidambar styraciflua - *Quercus* (*alba*, *falcata*) Forest Association (CEGL007217)	
FDX*	Ruderal Hardwood Forest
Maclura pomifera Semi-natural Forest Association (CEGL006627)	
FDX*	Ruderal Hardwood Forest
Pinus echinata Early-Successional Forest Association (CEGL006327)	
FSP*	Shortleaf Pine Forest
1.B.2.Na. Eastern North American Cool Temperate Forest Division	
M153. Central Mesophytic Hardwood Forest Macrogroup	
G020. Appalachian & Interior Mesophytic Forest Group	
Fagus grandifolia - *Quercus rubra* - *Tilia americana* var. *caroliniana* / *Magnolia tripetala* / *Podophyllum peltatum* Forest Association (CEGL007823)	
FBH	Ozark Rich Beech - Mixed Hardwood Forest
Quercus alba - *Quercus rubra* - *Acer saccharum* - *Carya cordiformis* / *Lindera benzoin* Forest Association (CEGL002058)	
FOM	White Oak - Red Oak - Sugar Maple Mesic Forest

Map-class Code	Map-class Name
M012. Central Oak-Hardwood & Pine Forest Macrogroup	
G158. Northeastern & North-Central Oak - Hickory Forest Group	
Quercus velutina - *Quercus alba* - *Carya* (*glabra*, *ovata*) Forest Association (CEGL002076)	
FDO*	Mixed Oak - (Hardwood) Dry Forest
M013. Eastern North American Ruderal Forest & Plantation Macrogroup	
G030. Northern & Central Hardwood & Conifer Ruderal Forest Group	
Gleditsia triacanthos - *Juglans nigra* / *Bromus secalinus* - *Poa pratensis* Successional Woodland Association (CEGL004345)	
FDX*	Ruderal Hardwood Forest
Robinia pseudoacacia Forest Association (CEGL007279)	
FDX*	Successional Hardwood Forest
M016. Southern Hardwood & Pine Forest Macrogroup	
G601. Chinkapin Oak - Shumard Oak - Blue Ash Alkaline Forest Group	
Juniperus ashei / *Cotinus obovatus* / *Carex eburnea* - *Rudbeckia missouriensis* Woodland Association (CEGL007833)	
WAJ*	Ozark Ashe's Juniper Woodland
Juniperus ashei Ozark Clifftop Woodland Association (CEGL004672)	
WAJ*	Ozark Ashe's Juniper Woodland
Juniperus virginiana Alkaline Bluff Woodland Association (CEGL002426)	
WRC	Red-cedar Alkaline Bluff Woodland
Quercus muehlenbergii - *Fraxinus* (*quadrangulata*, *americana*) / *Schizachyrium scoparium* Woodland Association (CEGL002143)	
WCO	Chinkapin Oak - Ash / Little Bluestem Woodland
Quercus muehlenbergii - *Quercus shumardii* Forest Association (CEGL004602)	
FDO*	Mixed Oak - (Hardwood) Dry Forest
G012. Shortleaf Pine - Oak Forest Group	
Pinus echinata - *Quercus* (*alba*, *rubra*) / *Vaccinium* (*arboreum*, *pallidum*) / *Schizachyrium scoparium* - *Chasmanthium sessiliflorum* - *Solidago ulmifolia* Forest Association (CEGL007489)	
FPO*	Shortleaf Pine - Oak Forest
Pinus echinata - *Quercus stellata* - *Quercus marilandica* / *Schizachyrium scoparium* Woodland Association (CEGL002393)	
WPO	Ozark/Ouachita Shortleaf Pine - Oak Dry Woodland
Pinus echinata - *Quercus velutina* - *Quercus stellata* / *Vaccinium* spp. Forest Association (CEGL002401)	
FPO*	Shortleaf Pine - Oak Forest

Map-class Code	Map-class Name
	Pinus echinata / *Vaccinium* (*arboreum*, *pallidum*, *stamineum*) Forest Association (CEGL002400)
FSP*	Shortleaf Pine Forest
	G159. South-Central Interior Oak Forest Group
	Juniperus virginiana - *Quercus* (*alba*, *stellata*) - *Carya texana* Forest Association (CEGL004803)
FCH	Ozark Red-cedar - Hardwood Forest
	Quercus alba - *Quercus rubra* - *Carya* (*alba*, *ovata*) / *Cornus florida* Acidic Forest Association (CEGL002067)
FDO*	Mixed Oak - (Hardwood) Dry Forest
	Quercus alba - *Quercus rubra* - *Quercus muehlenbergii* / *Cercis canadensis* Forest Association (CEGL002070)
FDO*	Mixed Oak - (Hardwood) Dry Forest
	Quercus alba - *Quercus stellata* - *Quercus velutina* / *Schizachyrium scoparium* Woodland Association (CEGL002150)
WOD*	Mixed Oak Dry Woodland
	Quercus alba - *Quercus velutina* - *Carya alba* / *Desmodium nudiflorum* Ozark Forest Association (CEGL004270)
FDO*	Mixed Oak - (Hardwood) Dry Forest
	Quercus falcata - *Carya alba* - *Carya ovata* Forest Association (CEGL004543)
FDO*	Mixed Oak - (Hardwood) Dry Forest
	Quercus marilandica / *Vaccinium arboreum* / *Danthonia spicata* Scrub Woodland Association (CEGL002425)
WOD*	Mixed Oak Dry Woodland
	Quercus stellata - *Quercus marilandica* - *Carya* (*glabra*, *texana*) / *Vaccinium arboreum* Forest Association (CEGL002075)
FDO*	Mixed Oak - (Hardwood) Dry Forest
	Quercus stellata - *Quercus marilandica* - *Quercus velutina* - *Carya texana* / *Schizachyrium scoparium* Woodland Association (CEGL002149)
WOD*	Floodplain Hardwood Forest*
	1.B.3.Na. Eastern North American Flooded & Swamp Forest Division
	M029.Northern & Central Floodplain Forest & Scrub Macrogroup
	G040. Silver Maple - Green Ash - Sycamore Floodplain Group
	Acer negundo - (*Platanus occidentalis*, *Populus deltoides*) Forest Association (CEGL004690)
FRH*	Riparian Hardwood Forest
	Acer negundo Forest Association (CEGL005033)
FBF	Box-elder Floodplain Forest
	Acer saccharinum - *Ulmus americana* Forest Association (CEGL002586)
FRH*	Riparian Hardwood Forest

Map-class Code	Map-class Name
	Betula nigra - *Platanus occidentalis* Forest Association (CEGL002086)
FRH*	Riparian Hardwood Forest
	Fraxinus pennsylvanica - *Celtis* spp. - *Quercus* spp. - *Platanus occidentalis* Bottomland Forest Association (CEGL002410)
FRH*	Riparian Hardwood Forest
	Fraxinus pennsylvanica - *Ulmus americana* - *Celtis laevigata* / *Ilex decidua* Forest Association (CEGL002427)
FRH*	Riparian Hardwood Forest
1.B.3.Nb.	Southeastern North American Flooded & Swamp Forest Division
M031.	Southern Floodplain Hardwood Forest Macrogroup
G034.	Oak - Sweetgum Floodplain Forest Group
	Arundinaria gigantea ssp. *gigantea* Shrubland Association (CEGL003836)
SCB	Floodplain Canebrake
	Liquidambar styraciflua - (*Quercus alba*, *Acer saccharum*) / *Carpinus caroliniana* / *Lindera benzoin* Forest Association (CEGL007826)
FRH*	Riparian Hardwood Forest
	Quercus macrocarpa - *Quercus shumardii* - *Carya cordiformis* / *Chasmanthium latifolium* Forest Association (CEGL004544)
FRH*	Riparian Hardwood Forest
2.	SHRUBLAND & GRASSLAND CLASS
2.B.2.Nc.	Eastern North American Grassland, Meadow & Shrubland Division
M124.	Northern & Central Alvar & Glade Macrogroup
G178.	Northern & Central Acidic Glade Group
	Quercus stellata - (*Pinus echinata*) / *Vaccinium arboreum* / *Andropogon gerardii* - *Symphyotrichum patens* var. *patentissimum* Wooded Herbaceous Vegetation Association (CEGL007814)
HCG*	Herbaceous Calcareous Glade
	Schizachyrium scoparium - *Aristida dichotoma* - *Croton willdenowii* / Lichens Wooded Herbaceous Vegetation Association (CEGL002242)
HSG	Ozark Sandstone Glade
G179.	Northern & Central Alkaline Glade Group
	Schizachyrium scoparium - *Bouteloua curtipendula* - *Rudbeckia missouriensis* - *Mentzelia oligosperma* Wooded Herbaceous Vegetation Association (CEGL002251)
HCG*	Herbaceous Calcareous Glade
	Schizachyrium scoparium - *Sorghastrum nutans* - *Bouteloua curtipendula* - *Rudbeckia missouriensis* - *Hedyotis nigricans* Wooded Herbaceous Vegetation Association (CEGL002398)
HCG*	Herbaceous Calcareous Glade

Map-class Code	Map-class Name
2.B.2.Ne. Southeastern North American Grassland & Shrubland Division	
M307. Southeastern Ruderal Grassland & Shrubland Macrogroup	
G583. Southeastern Old Field Group	
SMX*	Ruderal Shrubland
Andropogon virginicus var. *virginicus* Herbaceous Vegetation Association (CEGL004044)	
HMX*	Ruderal Herbaceous Field
Lolium (*arundinaceum*, *pratense*) Herbaceous Vegetation Association (CEGL004048)	
HMX*	Ruderal Herbaceous Field
2.B.5.Na. North American Bog & Fen Division	
M061. Appalachian, Interior Plateau & Prairie Fen Macrogroup	
G182. Interior Plateau Seepage Fen Group	
(*Carex interior*, *Carex lurida*) - *Carex leptalea* - *Parnassia grandifolia* - *Rhynchospora capillacea* Herbaceous Vegetation Association (CEGL002404)	
N/A	N/A
2.B.6.Na. Eastern North American Freshwater Wet Meadow, Riparian & Marsh Division	
M303. Eastern North American Ruderal Wet Meadow & Marsh Macrogroup	
G557. Southeastern Ruderal Wet Meadow & Marsh Group	
HMM*	Herbaceous Marsh & Wet Meadow
M165. Eastern North American Riverscour Wetland Macrogroup	
G194. Northern & Central Riverscour Wetland Group	
Alnus serrulata Interior Shrubland Association (CEGL003894)	
SHA	Interior Alder Shrubland
Hamamelis vernalis - *Cornus obliqua* - *Hypericum prolificum* Shrubland Association (CEGL003898)	
SGB*	Riverine Gravel Bar Shrubland
Salix caroliniana Temporarily Flooded Shrubland Association (CEGL007064)	
SGB*	Riverine Gravel Bar Shrubland
Ozark Riverine Cobble - Gravel Flats Sparse Vegetation Association (CEGL007012)	
VRG	Ozark Riverine Gravel Flats
M069. Eastern North American Wet Meadow & Marsh Macrogroup	
G125. Eastern North American Freshwater Marsh Group	
Schoenoplectus tabernaemontani - *Typha* spp. - *(Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation Association (CEGL002026)	
HMM*	Herbaceous Marsh & Wet Meadow

Map-class Code	Map-class Name
	Typha latifolia Southern Herbaceous Vegetation Association (CEGL004150)
HMM*	Herbaceous Marsh & Wet Meadow
5. AQUATIC WETLAND VEGETATION CLASS	
5.B.1.Na. North American Freshwater Aquatic Vegetation Division	
M108. Eastern North American Freshwater Aquatic Vegetation Macrogroup	
G114. Eastern North American Freshwater Aquatic Vegetation Group	
	Brasenia schreberi Eastern Herbaceous Vegetation Association (CEGL004527)
HFA	Watershield Pond
	Justicia americana Herbaceous Vegetation Association (CEGL004286)
N/A	N/A
6. ROCK VEGETATION CLASS	
6.B.2.Na. Eastern North American Temperate Cliff, Scree & Rock Vegetation Division	
M111. Eastern North American Cliff & Rock Vegetation Macrogroup	
G340. Eastern North American Talus & Bluff Group	
	Limestone - Dolostone Talus Sparse Vegetation Association (CEGL002308)
N/A	N/A
	Sandstone Interior Highlands Talus Sparse Vegetation Association (CEGL002309)
N/A	N/A
8. DEVELOPED VEGETATION CULTURAL CLASS	
Herbaceous & Woody Developed Vegetation Cultural Subclass (L2)	
Other Developed Urban / Built Up Vegetation Formation (L3)	
Developed Area (NLCD 2001; 21-24)	
CDV	Developed Area
NON-NVCS UNITS	
Non-Vegetated Water & Land (<1% vegetated)	
Non-Vegetated Water	
Open Water (NLCD 2001; 11)	
NSR	Stream & River
NWP	Open Water Pond

*Map class also represents other vegetation types.

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FPO – Shortleaf Pine - Oak Forest F-20

FCH – Ozark Red-cedar - Hardwood Forest F-21

FDO – Mixed Oak - (Hardwood) Dry Forest F-23

FBH – Ozark Rich Beech - Mixed Hardwood Forest F-25

FOM – White Oak - Red Oak - Sugar Maple Mesic Forest F-26

FPP – Pine Plantation Forest F-27

FRS – Ruderal Eastern Red-cedar - (Pine) Forest F-28

FDX – Ruderal Hardwood Forest F-29

FRH – Riparian Hardwood Forest F-30

FBF – Box-elder Floodplain Forest F-32

WAJ – Ozark Ashe's Juniper Woodland F-33

WRC – Red-cedar Alkaline Bluff Woodland F-35

WPO – Ozark/Ouachita Shortleaf Pine - Oak Dry Woodland F-37

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HMM – Herbaceous Marsh & Wet Meadow F-48

HFA – Watershield Pond F-49

VRG – Ozark Riverine Gravel Flats F-50

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O – Open Space (NLCD 21) F-51

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NSR – Stream & River F-52

NWP – Open Water Pond F-53

FSP – Shortleaf Pine Forest

The Shortleaf Pine Forest (FSP) map class represents the *Pinus echinata* Early-Successional Forest Association (CEGL006327) and the *Pinus echinata* / *Vaccinium* (*arboreum*, *pallidum*, *stamineum*) Forest Association (CEGL002400) in the NVCS. These two associations were initially mapped separately, which it was thought that the levels of disturbances could be discerned from viewing and interpreting the aerial imagery. The two associations were merged into one map class because results of the AA indicated confusion to each other in the mapping.

The FSP map class describes dry to dry-mesic pine-conifer forests wherein shortleaf pine is dominant. Sites usually have evidence of past disturbances, including wind, fire, and ice; timber management; tree harvests (selective or cutover); grazing cattle; and even agricultural crops. The natural disturbances and timber management practices are more likely linked to CEGL002400, whereas the more intensive anthropogenic disturbances are more likely linked CEGL006327. Sites of FSP are typically on acidic soils and geology; however due to anthropogenic disturbances, calcareous sites of FSP are not out of the ordinary.

In the tree-canopy layer, the RD of shortleaf pine to other conifers—particularly eastern red-cedar—is >75%, and the RD of conifers to hardwoods is >75%. Because of the variation in disturbance levels within the FSP map class, forest stands can range from old, tall trees with open canopies to young, short trees with closed, dense canopies. These distinctions in forest physiognomy are differentiated within the map layer by a set of physiognomic modifiers, which were applied to all vegetation map classes. It is noteworthy that planted red pine stands are described with the Pine Plantation Forest (FPP) map class.



FPO – Shortleaf Pine - Oak Forest

The Shortleaf Pine - Oak Forest (FPO) map class represents the *Pinus echinata* - *Quercus* (*alba*, *rubra*) / *Vaccinium* (*arboreum*, *pallidum*) / *Schizachyrium scoparium* - *Chasmanthium sessiliflorum* - *Solidago ulmifolia* Forest Association (CEGL007489) and the *Pinus echinata* - *Quercus velutina* - *Quercus stellata* / *Vaccinium* spp. Forest Association (CEGL002401) in the NVCS. These two associations were initially mapped separately by using an environmental model that showed levels of solar radiation, which it was thought would enable discernment between dry and dry-mesic forest sites. The two associations were merged into one map class because results of the AA indicated confusion to each other in the mapping. The environmental model had provided neither the resolution nor the precision necessary to clearly make these separations.

The FPO map class describes dry to dry-mesic pine-oak forests wherein shortleaf pine is the dominant conifer tree and black oak is usually the dominant hardwood tree. Dryer sites tend to have some element of post oak, which can dominate when tree canopies are more open; however, tree canopy closure is typically >60%. In the tree-canopy layer, the mutual RD of conifers and hardwoods is >25%, with an RD of shortleaf pine to conifers—particularly eastern red-cedar—of >75%. Site locations range from the dry sites of summits, ridges, and upper south-facing slopes to the dry-mesic sites of gentle, concave slopes. Sites of FPO are typically on acidic soils and geology.





FCH – Ozark Red-cedar - Hardwood Forest

The Ozark Red-cedar - Hardwood Forest (FCH) map class represents the *Juniperus virginiana* - *Quercus* (*alba*, *stellata*) - *Carya texana* Forest Association (CEGL004803) in the NVCS. To help map separate the FCH from the Ozark Ashe's Juniper Woodland (WAJ) and Red-cedar Alkaline Bluff Woodland (WRC) map classes, an environmental model was employed that involved a complex set of decision factors, which is described in further detail below.

The FCH map class describes stands of mixed eastern red-cedar and hardwoods that can have either a forest or a woodland physiognomy. These distinctions are differentiated within the map layer by a set of physiognomic modifiers, which were applied to all vegetation map classes. In the tree-canopy layer, the RD of red-cedar to other conifers—particularly shortleaf pine—is >25%, and the RD of conifers to hardwoods is >25%. Hardwoods are typically present, yet the RD of hardwoods to conifers can be <25%. Sites commonly occur in fire-suppressed locations or in response to selective cuts or cutovers from timber harvests; however, sites of FCH do not typically occur in areas that have received excessive anthropogenic disturbances from cultivated crops, heavy cattle grazing, and homesteads. Small herbaceous and woodland glades that are less than a MMU might be mapped (as inclusions) with the FCH map class.

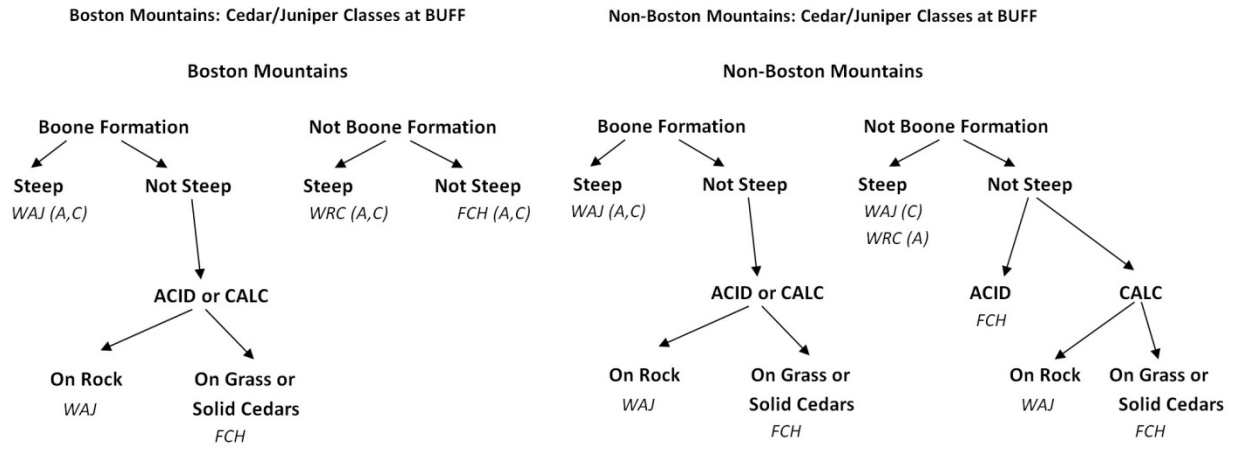
Because the FCH can have a woodland physiognomic characteristic to it, an environmental model was applied to the mapping. Along with the criteria described above, the FCH map class was used in any of the following environments:

- Boston Mountains – Slope Not Steep – Boone Geology – Acidic or Calcareous Soils – On Grass or Solid (dense-canopy) Red-cedars
- Boston Mountains – Slope Not Steep – Not Boone Geology – Acidic or Calcareous Soils – On Grass or Solid (dense-canopy) Red-cedars
- Not Boston Mountains – Slope Not Steep – Boone Geology – Acidic or Calcareous Soils – On Grass or Solid (dense-canopy) Red-cedars
- Not Boston Mountains – Slope Not Steep – Not Boone Geology – Acidic Soils
- Not Boston Mountains – Slope Not Steep – Not Boone Geology – Calcareous Soils – On Grass or Solid (dense-canopy) Red-cedars

A soil pH of ≥6.2 was considered calcareous, whereas a soil pH <6.2 was considered acidic. The diagrams on the next page show the decision process between all three map classes: FCH, WAJ, and WRC.

The environmental model provided some success to achieve accuracy standards in separating acidic and calcareous cedar/juniper types; that is, some map classes met accuracy whereas others did not. A decision was made, however, to keep the three map classes separate and accept the lower accuracies; the map classes were not merged together to gain an overall higher accuracy.

[A and ACID, Acidic; C and CALC, Calcareous]









FDO – Mixed Oak - (Hardwood) Dry Forest

The Mixed Oak - (Hardwood) Dry Forest (FDO) map class represents seven associations in the NVCS, as listed below:

- *Quercus velutina* - *Quercus alba* - *Carya* (*glabra*, *ovata*) Forest Association (CEGL002076)
- *Quercus muehlenbergii* - *Quercus shumardii* Forest Association (CEGL004602)
- *Quercus alba* - *Quercus rubra* - *Carya* (*alba*, *ovata*) / *Cornus florida* Acidic Forest Association (CEGL002067)
- *Quercus alba* - *Quercus rubra* - *Quercus muehlenbergii* / *Cercis canadensis* Forest Association (CEGL002070)
- *Quercus alba* - *Quercus velutina* - *Carya alba* / *Desmodium nudiflorum* Ozark Forest Association (CEGL004270)
- *Quercus falcata* - *Carya alba* - *Carya ovata* Forest Association (CEGL004543)
- *Quercus stellata* - *Quercus marilandica* - *Carya* (*glabra*, *texana*) / *Vaccinium arboreum* Forest Association (CEGL002075)

These seven associations were initially separated into three map classes by using a combination of two environmental models. The three initial map classes consisted of dry oak forests, dry-mesic acidic forests, and dry-mesic calcareous forests. The first model was one that showed levels of solar radiation, which it was thought would enable discernment between dry and dry-mesic forest sites (as well as mesic forest sites). The second model was one that showed whether sites are acidic or calcareous. The three original map classes were merged into one map class because results of the AA indicated confusion to each other in the mapping. Both environmental models had provided neither the resolution nor the precision necessary to clearly make these separations.

The FDO map class describes dry and dry-mesic oak-hardwood forests. Because the original map classes were merged into one, the site range is highly variable, from dry-xeric sites with thin soils on summit ridges to dry-mesic sites with more developed soils on various aspects and slopes. The driest sites are usually composed of short-scrubby trees of blackjack oak. The moister sites are usually composed of tall-erect trees of white oak and northern red oak. In the tree-canopy layer, the RD of oak-hardwoods to conifers is >75%. The RD of oaks to other hardwoods is normally >25%; however, where past selective harvesting of oak trees had occurred, the FDO map class was still used to map the forest because the floristic vegetation typically remains true to the dry forest types. A special modifier was used in the mapping to indicate the forest had been altered in this way. (This modifier was applied to all oak-hardwood and oak-pine forests where selective removal of tree species was thought to have occurred while the forest still functioning floristically as an oak-type forest.)







FBH – Ozark Rich Beech - Mixed Hardwood Forest

The Ozark Rich Beech - Mixed Hardwood Forest (FBH) map class represents the *Fagus grandifolia* - *Quercus rubra* - *Tilia americana* var. *caroliniana* / *Magnolia tripetala* / *Podophyllum peltatum* Forest Association (CEGL007823) in the NVCS. The mapping of FBH was reserved to the western half of the Upper River district of the BUFF: the area west of the confluence of the Buffalo and Little Buffalo Rivers. The majority of the mapping of FBH was in the Boxley Valley and Ponca Wilderness.

The FBH map class describes mixed-hardwood mesic forests in which the RD of American beech to other hardwoods is >20%. White oak and red oak are typical, whereas sugar maple is normally absent or few. FBH are located on steep north-facing slopes, yet can also occur on other aspects when in protected areas. Other site locations include deep ravines and coves, where the horizontal and vertical topography are concave in shape. In the tree-canopy layer, the RD of beech-hardwoods to conifers is >75%.



FOM – White Oak - Red Oak - Sugar Maple Mesic Forest

The White Oak - Red Oak - Sugar Maple Mesic Forest (FOM) map class represents the *Quercus alba* - *Quercus rubra* - *Acer saccharum* - *Carya cordiformis* / *Lindera benzoin* Forest Association (CEGL002058) in the NVCS. An environmental model that showed levels of solar radiation was employed to enable discernment between mesic and dry-mesic oak-hardwood forest sites. This solar-radiation model, however, did not successfully make the separation, according to the results of the AA. In a similar manner to the attempt to separate dry and dry-mesic oak-hardwood forests—which now constitutes the Mixed Oak - (Hardwood) Dry Forest (FDO) map class—the environmental model provided neither the resolution nor the precision necessary to clearly differentiate between mesic and dry-mesic oak-hardwood forests. Still, it was decided that the FOM map class would remain separate from the FDO map class; the FOM map class would not merge with the FDO map class and would accept the low accuracy report. The understanding from the analysis of the AA is that most of the confusion in mapping related not to entire mapped polygons but rather to small portions within them.

The FOM map class describes mesic oak-hardwood forests that consist of white oak and northern red oak and have an RD of sugar maple to hardwoods of >20%. American basswood is a commonly present. American beech is typically not present; however, when beech is present, it's only in low density and likely only in the western half of the Upper River district of the BUFF: the area west of the confluence of the Buffalo and Little Buffalo Rivers. In the tree-canopy layer, the RD of oak-hardwoods to conifers is >75%. The RD of oaks to other hardwoods is normally >25%; however, where past selective harvesting of oak trees had occurred, the FOM map class was still used to map the forest because the floristic vegetation typically remains true to the mesic forest types. A special modifier was used in the mapping to indicate the forest had been altered in this way. (This modifier was applied to all oak-hardwood and oak-pine forests where selective removal of tree species was thought to have occurred while the forest still functioning floristically as an oak-type forest.)





FPP – Pine Plantation Forest

The Pine Plantation Forest (FPP) map class represents the *Pinus echinata* Planted Forest Association (CEGL007169) and the *Pinus taeda* Planted Forest Association (CEGL007179) in the NVCS. The FPP map class describes pines that have been planted and that consist of shortleaf pine or loblolly pine. Planted pine forests are typically in rows of even-aged trees, with stands ranging from young and short to old and tall. It is noteworthy that the Shortleaf Pine Forest (FSP) map class describes older planted pine forests where the stand has reverted back to its natural characteristics, particularly understory floristic vegetation. These distinctions, however, can be hard to discern from the aerial imagery. Because the BUFF had entered the national park system 34 years prior to the date of the photography used for mapping, the approach to mapping pine plantations was conservative, and it was thought that most planted pine stands within the BUFF have taken on more natural understory characteristics.

No picture provided.

FRS – Ruderal Eastern Red-cedar - (Pine) Forest

The Ruderal Eastern Red-cedar - (Pine) Forest (FRS) map class represents the *Juniperus virginiana* var. *virginiana* - (*Quercus* spp.) Forest Association (CEGL007124) and the *Juniperus virginiana* var. *virginiana* - *Pinus echinata* - *Ulmus alata* / *Rhus glabra* Forest Association (CEGL007816) in the NVCS. These two associations were initially mapped separately; however, they were merged into one map class because results of the AA indicated confusion to each other in the mapping.

The FRS map class describes early-successional eastern red-cedar forests. Shortleaf pine is often present with the red-cedar; however, in the upper tree canopy, the RD of red-cedar to pine is >25%. A significant amount of hardwoods can be present, even with an RD of hardwoods to conifers of >25%. Tree canopies can be open or closed. Sites of FRS are of areas that have received extensive anthropogenic disturbance, including lands once used for crop cultivation; heavy cattle grazing, where the soil has been compacted; and homestead sites. Because these lands had been previously targeted for agricultural use, the soils tend to be more developed and deep, not thin. With the high level of disturbance, the floristic characteristics have been dramatically reshaped such that it no longer resembles the more natural version of the red-cedar forest, which is described by the Ozark Red-cedar - Hardwood Forest (FCH) map class.





FDX – Ruderal Hardwood Forest

The Ruderal Hardwood Forest (FDX) map class represents several associations in the NVCS, as listed below:

- *Liquidambar styraciflua* - *Quercus* (*alba*, *falcata*) Forest (CEGL007217)
- *Maclura pomifera* Semi-natural Forest (CEGL006627)
- *Gleditsia triacanthos* - *Juglans nigra* / *Bromus secalinus* - *Poa pratensis* Successional Woodland (CEGL004345)
- *Robinia pseudoacacia* Forest (CEGL007279)

The FDX map class describes ruderal forests that result from past anthropogenic disturbance (e.g., old field). In the tree-canopy layer, the RD of hardwoods to conifers (particularly eastern red-cedar and shortleaf pine) is >75%. Hardwoods consist of deciduous tree species both common and unique to the BUFF area, including sweetgum, black locust, black walnut, honeylocust, and Osage-orange. Some oak trees may be present in low density. These ruderal forests can have an open or closed tree canopy, as well as tall or short trees, including shrub-height trees (<5 m). (A distinction is made between shrub species and tree species that are "shrub" height.)





FRH – Riparian Hardwood Forest

The Riparian Hardwood Forest (FRH) map class represents several associations in the NVCS, as listed below:

- *Acer negundo* - (*Platanus occidentalis*, *Populus deltoides*) Forest (CEGL004690)
- *Acer saccharinum* - *Ulmus americana* Forest (CEGL002586)
- *Betula nigra* - *Platanus occidentalis* Forest (CEGL002086)
- *Fraxinus pennsylvanica* - *Ulmus americana* - *Celtis laevigata* / *Ilex decidua* Forest (CEGL002427)
- *Fraxinus pennsylvanica* - *Celtis* spp. - *Quercus* spp. - *Platanus occidentalis* Bottomland Forest (CEGL002410)
- *Liquidambar styraciflua* - (*Quercus alba*, *Acer saccharum*) / *Carpinus caroliniana* / *Lindera benzoin* Forest (CEGL007826)
- *Quercus macrocarpa* - *Quercus shumardii* - *Carya cordiformis* / *Chasmanthium latifolium* Forest (CEGL004544)

These seven associations were initially separated into four map classes by using multifaceted mapping convention—an environmental model, per se—that determined whether the riparian forest was part of either a large or small river system, as well as whether the riparian forest was within either a dynamic (high energy) or stable (low energy) flow portion of the riverine system. Results from the AA analysis showed low accuracies indicating confusion to each other in the mapping of the four original map classes. It was originally thought that specific associations only existed in one of these four map classes because of the large/small river and dynamic/stable flow conventions. From a closer study of the AA results, it became clear that these seven riparian forest associations were not restricted to one particular environmental setting (as obtained from the map-convention model). Therefore, these four map classes were merged into one map class, the FRH.

The FRH map class describes floodplain forests that belong to large or small rivers and receive regular or irregular flood waters. These floodplain forests can be located along the immediate margins of river corridors (the riverfront) or above the river channel on the higher terraces of the floodplain. They consist of hardwoods—a mixture of silver maple, eastern cottonwood, American sycamore, box-elder, American elm, green ash, and oaks—that can accommodate irregular flooding. Cottonwood and sycamore dominate the high dynamic portions of large rivers, such as the Buffalo River itself. Sweetgum and oaks dominate the low dynamic portions of small rivers, such as Clark Creek in the Boxley Valley. In the tree-canopy layer, conifers are typically absent.









FBF – Box-elder Floodplain Forest

The Box-elder Floodplain Forest (FBF) map class represents the *Acer negundo* Forest Association (CEGL005033) in the NVCS. The FBF map class describes hardwood floodplain forests that are successional and close to a monotypic stand of box-elder. The monotypic nature of the stand is in response to prior clear-cutting and cultivation. Other trees tolerant of disturbance can be present in small densities to the box-elder, including American elm, American walnut, black locust, and plum. The more heterogeneous in tree composition, however, the more likely the hardwood floodplain forest would be described with the Riparian Hardwood Forest (FRH) map class.



WAJ – Ozark Ashe's Juniper Woodland

The Ozark Ashe's Juniper Woodland (WAJ) map class represents the *Juniperus ashei* / *Cotinus obovatus* / *Carex eburnea* - *Rudbeckia missouriensis* Woodland Association (CEGL007833) and the *Juniperus ashei* Ozark Clifftop Woodland Association (CEGL004672) in the NVCS. Because of the similarities between these two associations, they were mapped together under one map class.

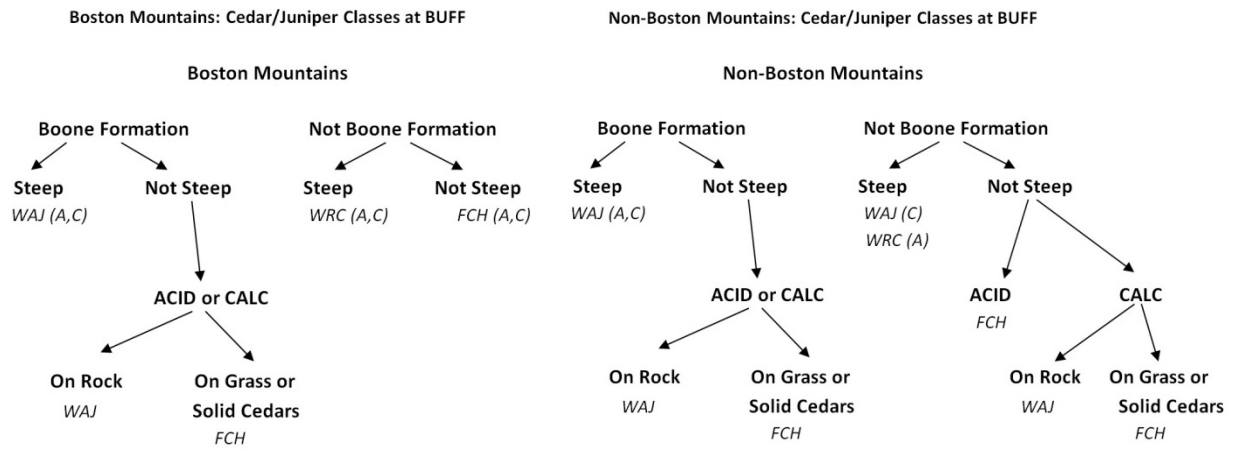
The WAJ map class describes conifer woodlands dominated by eastern red-cedar and/or Ashe's juniper and located on bluff tops and adjacent slopes, including intermediate ledges and steep bluff faces. Small herbaceous glades are common in these woodlands. Hardwoods can be present, yet the RD of hardwoods to conifers is <25%.

Because the WAJ resembles the vegetation associations that are represented by the Red-cedar Alkaline Bluff Woodland (WRC) and Ozark Red-cedar - Hardwood Forest (FCH) map classes, an environmental model was applied to the mapping. Along with the criteria described above, the WAJ map class was used in any of the following environments:

- Boston Mountains – Slope Steep – Boone Geology – Acidic or Calcareous Soils
- Boston Mountains – Slope Not Steep – Not Boone Geology – Acidic or Calcareous Soils – On Rock (or on grass with rock outcrops when borderline gentle/steep slope)
- Not Boston Mountains – Slope Steep – Boone Geology – Acidic or Calcareous Soils – Rocky or Grassy
- Not Boston Mountains – Slope Not Steep – Boone Geology – Acidic or Calcareous Soils – On Rock (or on grass with rock outcrops when borderline gentle/steep slope)
- Not Boston Mountains – Slope Steep – Not Boone Geology – Calcareous Soils – Rocky or Grassy
- Not Boston Mountains – Slope Not Steep – Not Boone Geology – Calcareous Soils – On Rock (or on grass with rock outcrops when borderline gentle/steep slope)

A soil/geology pH of ≥6.2 was considered calcareous, whereas a soil pH of <6.2 was considered acidic. The diagrams below show the decision process among all three map classes: WAJ, WRC, and FCH.

[A and ACID, Acidic; C and CALC, Calcareous]



The environmental model provided some success to achieve accuracy standards in separating acidic and calcareous cedar/juniper types; that is, some map classes met accuracy whereas others did not. A decision was made, however, to keep the three map classes separate and accept the lower accuracies; the map classes were not merged together to gain an overall higher accuracy.





WRC – Red-cedar Alkaline Bluff Woodland

The Red-cedar Alkaline Bluff Woodland (WRC) map class represents the *Juniperus virginiana* Alkaline Bluff Woodland Association (CEGL002426) in the NVCS.

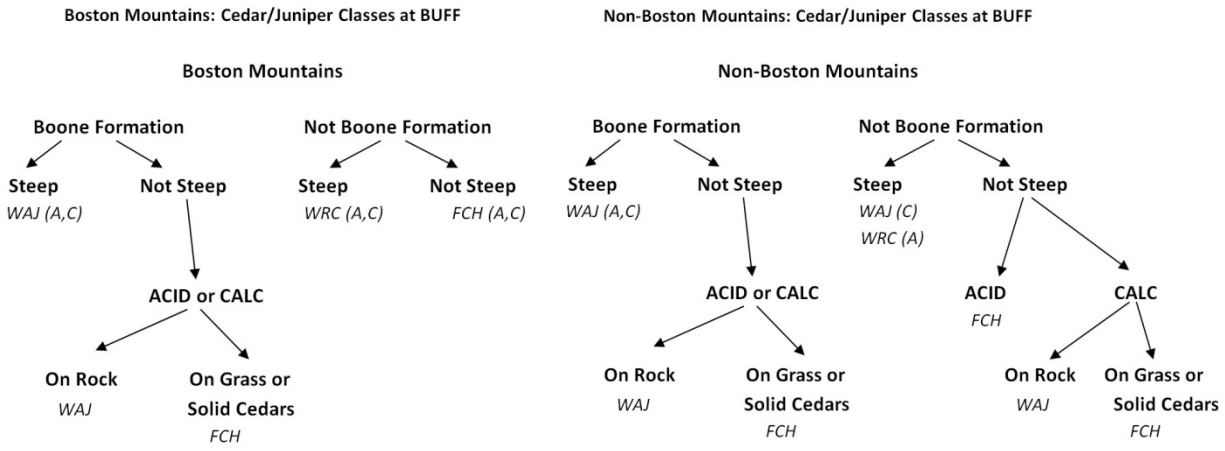
The WRC map class describes conifer woodlands dominated by eastern red-cedar and/or Ashe's juniper and located on bluff tops and adjacent slopes, including intermediate ledges and steep bluff faces. Small herbaceous glades are common in these woodlands. Hardwoods can be present, yet the RD of hardwoods to conifers is <25%.

Because the WRC resembles the vegetation associations that are represented by the Ozark Ashe's Juniper Woodland (WAJ) and Ozark Red-cedar - Hardwood Forest (FCH) map classes, an environmental model was applied to the mapping. Along with the criteria described above, the WRC map class was used in any of the following environments:

- Boston Mountains – Slope Steep – Not Boone Geology – Acidic or Calcareous Soils
- Not Boston Mountains – Slope Steep – Not Boone Geology – Acidic Soils – Rocky or Grassy

A soil/geology pH of ≥6.2 was considered calcareous, whereas a soil pH of <6.2 was considered acidic. The diagrams below show the decision process among all three map classes: WRC, WAJ, and FCH.

[A and ACID, Acidic; C and CALC, Calcareous]



The environmental model provided some success to achieve accuracy standards in separating acidic and calcareous cedar/juniper types; that is, some map classes met accuracy whereas others did not. A decision was made, however, to keep the three map classes separate and accept the lower accuracies; the map classes were not merged together to gain an overall higher accuracy.



WPO – Ozark/Ouachita Shortleaf Pine - Oak Dry Woodland

The Ozark/Ouachita Shortleaf Pine - Oak Dry Woodland (WPO) map class represents the *Pinus echinata* - *Quercus stellata* - *Quercus marilandica* / *Schizachyrium scoparium* Woodland Association (CEGL002393) in the NVCS. The WPO map class describes dry-xeric, open-canopy woodlands composed of shortleaf pine, post oak, and blackjack oak; the pine often emerges over scrub-stature oak. The understory vegetation is typically herbaceous with few shrubs. Sites are typically located on dry-xeric, south-facing slopes. In the tree-canopy layer, the mutual RD of conifers and hardwoods is >25%. Sites of WPO that are less than the size of a MMU are likely mapped (as inclusions) by the Shortleaf Pine - Oak Forest (FPO) map class.



WCO – Chinquapin Oak - Ash / Little Bluestem Woodland

The Chinquapin Oak - Ash / Little Bluestem Woodland (WCO) map class represents the *Quercus muehlenbergii* - *Fraxinus* (*quadrangulata*, *americana*) / *Schizachyrium scoparium* Woodland Association (CEGL002143) in the NVCS.

The WCO map class describes hardwood woodlands that are dry-xeric and open canopy. Dominant hardwoods consist of chinquapin oak and shumard oak, as well as blue ash. Sites are typically on calcareous soils and geology, commonly associated to limestone and dolomite outcrops. The understory is herbaceous with few shrubs. Herbaceous glade types—ones represented by the Herbaceous Calcareous Glade (HCG) map class—that are less than the size of a MMU are likely mapped (as inclusions) by the WCO map class. In the tree-canopy layer, the RD of oak-hardwoods to conifers is >75%. In the shrub layer of fire-suppressed locations, a significant amount of eastern red-cedar and Ashe's juniper may be present; however, the RD of red-cedar and juniper trees (even short trees) to hardwoods is <25%. It is noteworthy that some degraded versions of WCO might be included within the Ozark Red-cedar - Hardwood Forest (FCH) map class.



WOD – Mixed Oak Dry Woodland

The Mixed Oak Dry Woodland (WOD) map class represents several associations in the NVCS, as listed below:

- *Quercus alba* - *Quercus stellata* - *Quercus velutina* / *Schizachyrium scoparium* Woodland (CEGL002150)
- *Quercus marilandica* / *Vaccinium arboreum* / *Danthonia spicata* Scrub Woodland (CEGL002425)
- *Quercus stellata* - *Quercus marilandica* - *Quercus velutina* - *Carya texana* / *Schizachyrium scoparium* Woodland (CEGL002149)

Because of the similarities among these three associations, they were mapped together under one map class.

The WOD map class describes hardwood woodlands that are dry-xeric to dry-mesic and open canopy. Dominant hardwoods may consist of white oak, post oak, and black oak, as well as some presence of black hickory and blackjack oak. In dry-xeric sites, the oaks are often stunted and scrub-stature. Sites are typically on acidic soils and geology and are commonly associated with the St. Peter Sandstone and Boone geology formations. The understory is herbaceous with few shrubs. In the tree-canopy layer, the RD of oak-hardwoods to conifers is >75%. Sites of WOD that are less than the size of a MMU are likely mapped (as inclusions) by of the Mixed Oak - (Hardwood) Dry Forest (FDO) map class.





SMX – Ruderal Shrubland

The SMX – Ruderal Shrubland (SMX) map class represents the Southeastern Old Field Group (G583) in the NVCS. Because of disturbance from human activity and the inherent variability of floristic vegetation in these ruderal shrublands, floristic types were not determined. Yet the field data collected from sites of SMX suggests that two shrub-type associations might exist. They are the *Rubus* (*argutus*, *trivialis*) - *Smilax* (*glauca*, *rotundifolia*) Shrubland Association (CEGL004732) and the *Cornus drummondii* - (*Prunus* spp., *Rhus aromatica*) Shrubland (CEGL007933). It is noteworthy that because the SMX map class incorporates a broad spectrum of shrub in disturbance settings, the shrubland concept of SMX is broader than the two shrub associations listed.

The SMX map class describes ruderal upland shrublands that result from past or present human disturbance, including old fields, forest clear-cuts, and power line right-of-ways. Shrubs contribute >25% of cover and consist of any species common or unique to the BUFF area, usually deciduous, such as *Prunus* spp.; some amount of eastern red-cedar shrubs can be present.





SCB – Floodplain Canebrake

The Floodplain Canebrake (SCB) map class represents the *Arundinaria gigantea* ssp. *gigantea* Shrubland Association (CEGL003836) in the NVCS. The SCB map class describes dense stands of cane on riparian terraces and terrace edges. Cane contributes >25% of cover with a tree canopy of <25%. It is noteworthy that extensive stands of canebrake can exist as an understory shrub to floodplain hardwood forest types that are represented by the Riparian Hardwood Forest (FRH) map class.





SHA – Interior Alder Shrubland

The Interior Alder Shrubland (FPH) map class represents the *Alnus serrulata* Interior Shrubland Association (CEGL003894) in the NVCS.

The SHA map class describes shrub wetlands in Boxley Valley. The shrub wetland is along the margins of an herbaceous pond that is impounded by beaver and is spring-fed from the adjacent hills. Shrub cover is >25% with hazel alder as the dominant shrub.





SGB – Riverine Gravel Bar Shrubland

The Riverine Gravel Bar Shrubland (SGB) map class represents the *Hamamelis vernalis* - *Cornus obliqua* - *Hypericum prolificum* Shrubland (CEGL003898) and the *Salix caroliniana* Temporarily Flooded Ozark Shrubland (CEGL007064) in the NVCS. Because of the similarities between these two associations, they were mapped together under one map class.

The SGB map class describes shrublands located on cobble, gravel, and sand bars of rivers that have been dynamically formed and scoured by regular flood waters. Shrubs include witch-hazel, Carolina willow, rough-leaved dogwood, indigo bush, and shrub-height American sycamore trees. Canopy cover of shrubs can be sparse, as low as 10%. Tree canopy—those taller than shrub-height—is <25% cover.

Because the cobble, gravel, and sand substrate gave off high-reflectance on the aerial imagery (overexposing the imagery), the sparser coverage of shrubs were often obscured or diffused from view. Thus, an aggressive approach to mapping SGB was performed. Where even hints of shrub presence were viewed, the SGB map class was employed.







HSG – Ozark Sandstone Glade

The Ozark Sandstone Glade (HSG) map class represents the Schizachyrium scoparium - *Aristida dichotoma* - *Croton willdenowii* / Lichens Wooded Herbaceous Vegetation Association (CEGL002242) in the NVCS.

The HSG map class describes herbaceous glades located on the thin soils of sandstone geological formations found on bluff tops and adjacent slopes, including intermediate ledges and steep bluff faces. The flora of these herbaceous glades has an acidic affinity. Dominant grasses include little bluestem and three-awn grasses, as well as the forb Willdenow's croton. Shrubs and trees—often eastern red-cedar and Ashe's juniper—may be present yet each (shrub and tree) contribute <25% cover. Sites of HSG that are less than the size of a MMU are likely mapped (as inclusions) by surrounding forests and woodlands, such as the Ozark Ashe's Juniper Woodland (WAJ) map class.

Herbaceous glades in general were easily identified by viewing the aerial imagery; however, it was difficult to distinguish between the herbaceous content represented by the HSG map class and that represented by the Herbaceous Calcareous Glade (HCG) map class. Therefore, an environmental model was applied to the mapping to separate HSG from HCG. This model presented a break line at a particular pH level. A soil/geology pH of ≥6.2 was considered calcareous, whereas a soil pH of <6.2 was considered acidic. The HSG map class was employed to map herbaceous glades that were designated by the pH model as having a pH of <6.2. For those with a pH of ≥6.2, the HCG map class was used.



HCG – Herbaceous Calcareous Glade

The Herbaceous Calcareous Glade (HCG) map class represents several associations in the NVCS, as listed below:

- *Quercus stellata* - (*Pinus echinata*) / *Vaccinium arboreum* / *Andropogon gerardii* - *Symphyotrichum patens* var. *patentissimum* Wooded Herbaceous Vegetation (CEGL007814)
- *Schizachyrium scoparium* - Bouteloua curtipendula - *Rudbeckia missouriensis* - *Mentzelia oligosperma* Wooded Herbaceous Vegetation (CEGL002251)
- *Schizachyrium scoparium* - *Sorghastrum nutans* - Bouteloua curtipendula - *Rudbeckia missouriensis* - *Hedyotis nigricans* Wooded Herbaceous Vegetation (CEGL002398)

The HCG map class describes herbaceous glades located on the thin soils of dolomite, limestone, or basic sandstone geological formations found on bluff tops and adjacent slopes, including intermediate ledges and steep bluff faces. The flora of these herbaceous glades has a calcareous (basic) affinity. Dominant grasses include big bluestem, little bluestem, slimleaf panicgrass, and poverty oatgrass, as well as forbs of tall thoroughwort and diamondflowers. Shrubs and trees—often eastern red-cedar, black hickory, dwarf hackberry, white ash, fragrant sumac oak, post oak, and chinquapin oak—may be present yet each (shrub and tree) contribute <25% cover. Sites of HCG that are less than the size of a MMU are likely mapped (as inclusions) by surrounding forests and woodlands, such as the Chinquapin Oak - Ash / Little Bluestem Woodland (WCO) map class.

Herbaceous glades in general were easily identified by viewing the aerial imagery; however, it was difficult to distinguish between the herbaceous content represented by the HSG map class and that represented by the Herbaceous Calcareous Glade (HCG) map class. Therefore, an environmental model was applied to the mapping to separate HCG from HSG. This model presented a break line at a particular pH level. A soil/geology pH of ≥6.2 was considered calcareous, whereas a soil pH of <6.2 was considered acidic. The HCG map class was employed to map herbaceous glades that were designated by the pH model as having a pH of ≥6.2. For those with a pH of <6.2, the HSG map class was used.





HMX – Ruderal Herbaceous Field

The Ruderal Herbaceous Field (HMX) map class represents the *Andropogon virginicus* var. *virginicus* Herbaceous Vegetation (CEGL004044) and the *Lolium* (*arundinaceum*, *pratense*) Herbaceous Vegetation (CEGL004048) in the NVCS. These two associations were mapped together. Although each herbaceous type can be obvious to what they are from an aerial image perspective, there was too much "middle ground" where the two types would be confused with each other.

The HMX map class describes ruderal herbaceous fields in upland sites where shrubs and trees each contribute <25% cover. Herbaceous lands that contain power line right-of-ways are included. Herbaceous vegetation consists of various grasses and herbs common or unique to the BUFF area; however, the emphasis is on non-native vegetation.

Cool-season herbaceous fields include cultivated fields that are maintained primarily for hay and pastureland, such as those commonly found in the Boxley Valley. Some of these lands are managed for hay production, whereas others are preserved for a historical landscape perspective or to provide grazing for elk. Cool-season herbaceous fields are typically located on the upper terraces of rivers and streams.

Warm-season herbaceous fields are typically left fallow and idle. Some are fields that were once managed for cool-season grasses but have since begun reverting back to warm-season vegetation. Warm-season herbaceous fields are more typically located above the riparian terraces on hill sides and ridge tops; however, they also exist in upper terraces of river and streams, such where cool-season herbaceous fields are converting to warm-season vegetation. Some warm-season herbaceous fields are managed to remove shrub and tree encroachment, thus keeping the lands open for grazing for elk.









HMM – Herbaceous Marsh & Wet Meadow

The Herbaceous Marsh & Wet Meadow (HMM) map class represents three vegetation types—one group and two associations—in the NVCS, as listed below:

- Southeastern Ruderal Wet Meadow & Marsh Group (G557)
- *Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation Association (CEGL002026)
- *Typha latifolia* Southern Herbaceous Vegetation Association (CEGL004150)

The two emergent wetland associations were mapped together because from an aerial image perspective, they appear very similar. The ruderal wetland group type was initially mapped separately from the two association types; however, they were merged into one map class because results of the AA indicated confusion to each other in the mapping.

The HMM map class describes emergent herbaceous meadow and marsh wetlands. These wetlands are unique to the BUFF, typically occurring within floodplain terrace lands of the Buffalo River; most occurrences of HMM mapping were in the Boxley Valley.

The herbaceous meadows consist of herbaceous vegetation that is ruderal; disturbance is normative and anthropogenic. Examples of the HMM map class include the wetland margins of man-made impoundments, wet-mesic margins of field edges adjacent to the river, and depressions on the river terrace. Some herbaceous meadows have been integrated into the cool-season grass meadows and so are mapped inherently by the Ruderal Herbaceous Field (HMX) map class.

The herbaceous wet marshes consist of herbaceous vegetation typical of shallow to deep marshes, including bulrush, broadleaf cattail, sedges, and bur reed. The best example of HMM is in the Boxley Valley where an herbaceous pond is impounded by beaver and spring-fed from the adjacent hills.



HFA – Watershield Pond

The Watershield Pond (HFA) map class represents the *Brasenia schreberi* Eastern Herbaceous Vegetation (CEGL004527) in the NVCS. The HFA class describes deep water marshes where floating-leaved aquatic vegetation (mostly of watershield) contributes >10% cover and where herbaceous emergent vegetation contributes <25% cover. Submergent vegetation may be of high density. Sites of HFA are customarily located in small man-made impoundments in the uplands of the BUFF. The only example of a naturally occurring HFA is in the Boxley Valley and is impounded by beaver and spring-fed from the adjacent hills.



VRG – Ozark Riverine Gravel Flats

The Ozark Riverine Gravel Flats (VRG) map class represents Ozark Riverine Cobble - Gravel Flats Sparse Vegetation (CEGL007012) in the NVCS. The VRG map class describes cobble, gravel, and sand bars in and along dynamic portions of rivers and streams. The total vegetation cover is <10% and consists mostly of herbaceous vegetation. The sparse vegetation is a response to dynamic water-level fluctuations and scouring from frequent flood events.

It is noteworthy that because the cobble, gravel, and sand substrate gave off high-reflectance on the aerial imagery (overexposing the imagery), the sparser coverage of shrubs were often obscured or diffused from view. Thus, an aggressive approach was taken with the Riverine Gravel Bar Shrubland (SGB) map class. Where even hints of shrubs were in view, the SGB map class was employed.



CDV – Developed Area

The Developed Area (CDV) map class falls under the Developed Vegetation Cultural Class (8) in the NVCS, where it is defined down to Level 3—Other Developed Urban / Built Up Vegetation Formation. From there, a finer subdivision is defined with the use of modifiers, which depict the amount of impervious surface of developed areas. These modifiers represent classes 21–24 in the NLCD. The CDV map class describes areas that humans regularly use. Examples at the BUFF include roads and their right-of-ways, urban areas, homesteads and farmsteads, campgrounds, picnic areas, and various BUFF grounds (such as visitor centers and building structures).

The following sections describe classes 21–24 in the NLCD, which were used to further attribute (using a special modifier) the CDV map class. (It is noteworthy that for purposes of consistency in coding with the NVCS, the following codes were assigned to the CDV map-class modifiers: CEGLNLCD21, CEGLNLCD22, CEGLNLCD23, and CEGLNLCD24.)

O – Open Space (NLCD 21)

This class includes areas consisting mostly of vegetation in the form of lawn grasses but that also have a mixture of some constructed materials. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot, single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.

L – Low Intensity (NLCD 22)

This class includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20–49% of total cover. These areas most commonly include single-family housing units.

M – Medium Intensity (NLCD 23)

This class includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50–79% of total cover. These areas most commonly include single-family housing units.

H – High Intensity (NLCD 24)

This class includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses, and commercial/industrial facilities. Impervious surfaces account for 80–100% of the total cover.







NSR – Stream & River

The Stream & River (NSR) map class represents, in part, the Open Water (11) class in the NLCD. (It is noteworthy that for purposes of consistency in coding with the NVCS, the code CEGLNLCD11 was assigned to the NSR map class.)

The NSR map class describes open water streams and rivers, including the Buffalo River and its many tributaries. Streams that were too narrow to map were included in the mapping of the surrounding lands. It is worth noting that the mapping of NSR was limited to water levels at the time of aerial photography (October 2006). Water levels during the fall are normally low. With aerial photographs taken in the fall, portions of rivers and small streams (some even in their entirety) may be mapped with the Ozark Riverine Gravel Flats (VRG) map class; they appear dry and exposed on the aerial image.

Wetland vegetation may be present (usually in shallow waters close to shorelines) but contribute <10–25% cover; however, small areas (below the size of a MMU) of wetland vegetation with >10–25% cover—including herbaceous vegetation, shrubs, and trees—may be included in the mapping of NSR. Wetland vegetation types were often mapped to half the size of the MMU when distinct from their immediate surroundings. Open rivers and streams provide such an environment.



NWP – Open Water Pond

The Open Water Pond (NWP) map class represents, in part, the Open Water (11) class in the NLCD. (It is noteworthy that for purposes of consistency in coding with the NVCS, the code CEGLNLCD11 was assigned to the NSR map class.)

The NWP map class describes open water ponds, which are <8 ha in area and have wetland vegetation cover of <10–25%. Open water ponds are usually too deep for vegetation to take root. Wetland vegetation—aquatic and/or emergent—may be present (usually in shallow waters close to shorelines) but contribute <10–25% cover; however, small areas (below the size of a MMU) of wetland vegetation with >10–25% cover—including herbaceous vegetation, shrubs, and trees—may be present with the mapping of NWP. It is worth noting that wetland vegetation types were often mapped to half the size of the MMU when distinct from their immediate surroundings. Open water ponds provide such an environment.

No picture provided.

Table F-3. Map classification listing, sorted alphabetically by map-class code, used for the Buffalo National River (Arkansas) vegetation mapping project.

Map-class Code	Map-class Name
CDV	Developed Area
FBF	Box-elder Floodplain Forest
FBH	Ozark Rich Beech - Mixed Hardwood Forest
FCH	Ozark Red-cedar - Hardwood Forest
FDO	Mixed Oak - (Hardwood) Dry Forest
FDX	Ruderal Hardwood Forest
FOM	White Oak - Red Oak - Sugar Maple Mesic Forest
FPO	Shortleaf Pine - Oak Forest
FPP	Pine Plantation Forest
FRH	Riparian Hardwood Forest
FRS	Ruderal Eastern Red-cedar - (Pine) Forest
FSP	Shortleaf Pine Forest
HCG	Herbaceous Calcareous Glade
HFA	Watershield Pond
HMM	Herbaceous Marsh & Wet Meadow
HMX	Ruderal Herbaceous Field
HSG	Ozark Sandstone Glade
NSR	Stream & River
NWP	Open Water Pond
SCB	Floodplain Canebrake
SGB	Riverine Gravel Bar Shrubland
SHA	Interior Alder Shrubland
SMX	Ruderal Shrubland
VRG	Ozark Riverine Gravel Flats
WAJ	Ozark Ashe's Juniper Woodland
WCO	Chinquapin Oak - Ash / Little Bluestem Woodland
WOD	Mixed Oak Dry Woodland
WPO	Ozark/Ouachita Shortleaf Pine - Oak Dry Woodland
WRC	Red-cedar Alkaline Bluff Woodland

Appendix G: Accuracy Assessment Form

NPS VEGETATION MAPPING PROGRAM: ACCURACY ASSESSMENT POINT FORM

Park name:_**BUFF**_ State Name:_**AR**__**Plot name recorded in GPS unit_____ PLOT CODE_____**

Survey Date _____ **Time (CST)** _____

Observers_____

Choose one: LAT/LONG / **UTM**; Choose one: **NAD83** / NAD27 / WGS84; **WAAS enabled Y N**

GPS Data: **X**_____ **Y**_____ **Averaging? Y N** ____ iterations

GPS Accuracy (in m) _____ **Elev**_____m/ft UTM Zone _**15**_ No. of sats:___

Slope	**Aspect**	
Categorical (Circle one below) OR Degrees_____	**Categorical (Circle one) OR Degrees_____**	
Flat 0 degrees	**Flat**	
Gentle 0-5 degrees	**Variable**	
Moderate 6-14 degrees	**N 338-22 degrees**	**S 158-202 degrees**
Somewhat steep 15-25 degrees	**NE 23-67 degrees**	**SW 203-247 degrees**
Steep 26-45 degrees	**E 68-112 degrees**	**W 248-292 degrees**
Very steep 45-69 degrees	**SE 113-157 degrees**	**NW 293-337 degrees**
Abrupt 70-100 degrees		
Overhanging sheltered 100+ degrees		

If GPS position is an *intentional* offset from the waypoint, circle the explanation:

a. **Mosaicing scenario (too heterogeneous to key because of two or more types within obs area**
b. **Physical constraints in reaching waypoint**
c. **Other (explain in notes below)**

Is the area of the veg type being assessed around the point at least equivalent to 1 MMU? **Y N**

(e.g. is the vegetation very patchy or does it appear to be on the edge between two types? MMU = 0.5 ha or a circle with radius 40m)

Field community name (in your own words)_____

Provisional CEGL code _____ (ONLY ONE CHOICE ALLOWED)

Second Call (if there is doubt about first call) _____

Final Veg Assoc Name (OFFICE USE ONLY)_____

Fit (does stand key easily to an association?): **H M L** Your **confidence** in determination: **H M L**
Classification Comments *(explain Veg Key Fit if it is M or L)*:

Choose one: Forest Woodland Shrubland Herbaceous

Dominant Canopy Species:__________

_____

OPTIONAL SECTION (generally only filled out if not confident about your vegetation call)

Rock Type_____ Surficial Deposits:_____

Subcanopy:______

Shrubs:______

Herbs:______

List any indicator species present:

Notes (continue on back if needed); map or diagram of polygon and area of assessment if particularly difficult to identify as one type

Appendix H: Accuracy Assessment Contingency Table

Explanation of the Contingency Matrix

The accuracy assessment (AA) contingency matrix for the Buffalo National River vegetation map layer is an array of numbers set out in rows and columns to compare results of vegetation types represented on the map layer to vegetation types as verified on the ground. Map-class codes are used to identify vegetation types for ease of comparison during the analysis and are listed at the side of each row and the top of each column. (A crosswalk between map classes and vegetation types is provided in the Main Report and in Appendix F: Descriptions of Map Classes. The crosswalk reveals the various vegetation types assigned to the map-class codes that are used to label vegetation types in this contingency table.)

The columns represent vegetation types in the National Vegetation Classification Standard (NVCS), Version 2 (FGDC 2008). These columns tabulate the producer's accuracy by showing errors of exclusion (omission errors) present in the map. The rows represent the map classes listed by their respective map-class codes. (Again, refer to the crosswalk for map class-names and links to vegetation types.) These rows tabulate the users' accuracy by showing errors of inclusion (commission errors) present in the map.

The following contingency matrix is formatted to a letter-size page (8.5" x 11") in landscape orientation.

		FIELD SAMPLES - REFERENCE DATA																									COMISSION			
	MAP CODES	FBF	FBH	FCH	FPP	FDX	FDO	FOM	FPO	FSP	FRS	FRH	WAJ	WCO	WOD	WPO	WRC	SCB	SGB	SHA	SMX	HCG	HFA	HSG	HMX	HMM	VRG	TOTAL	USERS' ACCUR-ACY	90% Confidence Intervals -	90% Confidence Intervals +
MAP DATA - PREDICTION DATA	FBF	26				2						4																32	81%	68%	94%
	FBH		16				5	1																				22	73%	55%	91%
	FCH			22			7						1	1			1											32	69%	54%	84%
	FPP				2																							2	100%	75%	125%
	FDX	1				28	1		1																			31	90%	80%	101%
	FDO					1	114					1		3														119	96%	92%	99%
	FOM		1				21	5																				27	19%	4%	33%
	FPO			2		1	7		64	3																		77	83%	75%	91%
	FSP			5	2				6	44	1																	58	76%	66%	86%
	FRS			3		4	5		13	3	26	1		3							2							60	43%	32%	55%
	FRH	3				1	3					110							3		1							121	91%	86%	96%
	WAJ			8			3						14	2			1											28	50%	33%	67%
	WCO						6							19	4							1						30	63%	47%	79%
	WOD						1							2	3													6	50%	8%	92%
	WPO			1								1			2	10	2											16	63%	39%	86%
	WRC			8					1								14					2		2				27	52%	34%	70%
	SCB	1				1						3						26										31	84%	71%	96%
	SGB											1							27		2							30	90%	79%	101%
	SHA																			1						1		2	50%	-33%	133%
	SMX		1																1		27							29	93%	84%	103%
	HCG																					26		2				28	93%	83%	103%
	HFA																						5					5	100%	90%	110%
	HSG																					2		9				11	82%	58%	105%
	HMX																								29			29	100%	98%	102%
	HMM											1														6		7	86%	57%	115%
	VRG																										29	29	100%	98%	102%
OMISSION	Total	31	18	49	4	38	173	6	85	50	27	122	15	30	9	10	18	26	31	1	32	31	5	13	29	7	29	889	Total Samples		
	PRODUCERS' ACCURACY	84%	89%	45%	50%	74%	66%	83%	75%	88%	96%	90%	93%	63%	33%	100%	78%	100%	87%	100%	84%	84%	100%	69%	100%	86%	100%	889			
	90% Confidence Interval -	71%	74%	32%	-4%	61%	60%	50%	67%	79%	88%	85%	79%	47%	2%	95%	59%	98%	76%	50%	72%	71%	90%	44%	98%	57%	98%	Total Samples Correct			
	90% Confidence Interval +	96%	104%	58%	104%	87%	72%	117%	84%	97%	104%	95%	107%	79%	65%	105%	97%	102%	99%	150%	96%	96%	110%	94%	102%	115%	102%	702			
		OVERALL ACCURACY = 78.9% KAPPA INDEX = 77.3% KAPPA INDEX LOWER 90% CONFIDENCE LEVEL = 75.0% KAPPA INDEX UPPER CONFIDENCE LEVEL = 79.7%																													

Code	P(row 1)	P(col i)	P(chance i)
FBF	0.035996	0.034871	0.001255
FBH	0.024747	0.020247	0.000501
FCH	0.035996	0.055118	0.001984
FPP	0.002250	0.004499	0.000010
FDX	0.034871	0.042745	0.001491
FDO	0.133858	0.194601	0.026049
FOM	0.030371	0.006749	0.000205
FPO	0.086614	0.095613	0.008281
FSP	0.065242	0.056243	0.003669
FRS	0.067492	0.030371	0.002050
FRH	0.136108	0.137233	0.018678
WAJ	0.031496	0.016873	0.000531
WCO	0.033746	0.033746	0.001139
WOD	0.006749	0.010124	0.000068
WPO	0.017998	0.011249	0.000202
WRC	0.030371	0.020247	0.000615
SCB	0.034871	0.029246	0.001020
SGB	0.033746	0.034871	0.001177
SHA	0.002250	0.001125	0.000003
SMX	0.032621	0.035996	0.001174
HCG	0.031496	0.034871	0.001098
HFA	0.005624	0.005624	0.000032
HSG	0.012373	0.014623	0.000181
HMX	0.032621	0.032621	0.001064
HMM	0.007874	0.007874	0.000062
VRG	0.032621	0.032621	0.001064
P(chance)	Total	1	0.073604

P(correct)	0.79
P(chance)	0.073604

Kappa	0.773315
90%CI -	0.749653
90%CI+	0.796977

Key to Map-class Codes and Crosswalk to NVCS Vegetation Types (organized alphabetically)

Code	Map-class Name	NVCS Codes
FBF	Box-elder Floodplain Forest	CEGL005033
FBH	Ozark Rich Beech - Mixed Hardwood Forest	CEGL007823
FCH	Ozark Red-cedar - Hardwood Forest	CEGL004803
FDO	Mixed Oak - (Hardwood) Dry Forest	CEGL002076, CEGL004602, CEGL002067, CEGL002070, CEGL004270, CEGL004543, CEGL002075
FDX	Ruderal Hardwood Forest	CEGL007217, CEGL006627, CEGL004345, CEGL007279
FOM	White Oak - Red Oak - Sugar Maple Mesic Forest	CEGL002058
FPO	Shortleaf Pine - Oak Forest	CEGL007489, CEGL002401
FPP	Pine Plantation Forest	CEGL007169, CEGL007179
FRH	Riparian Hardwood Forest	CEGL004690, CEGL002586, CEGL002086, CEGL002410, CEGL002427, CEGL007826, CEGL004544
FRS	Ruderal Eastern Red-cedar - (Pine) Forest	CEGL007124, CEGL007816
FSP	Shortleaf Pine Forest	CEGL006327, CEGL002400
HCG	Herbaceous Calcareous Glade	CEGL007814, CEGL002251, CEGL002398
HFA	Watershield Pond	CEGL004527
HMM	Herbaceous Marsh & Wet Meadow	G557, CEGL002026, CEGL004150
HMX	Ruderal Herbaceous Field	CEGL004044, CEGL004048
HSG	Ozark Sandstone Glade	CEGL002242
SCB	Floodplain Canebrake	CEGL003836
SGB	Riverine Gravel Bar Shrubland	CEGL003898, CEGL007064
SHA	Interior Alder Shrubland	CEGL003894
SMX	Ruderal Shrubland	G583
VRG	Ozark Riverine Gravel Flats	CEGL007012
WAJ	Ozark Ashe's Juniper Woodland	CEGL007833, CEGL004672
WCO	Chinquapin Oak - Ash / Little Bluestem Woodland	CEGL002143
WOD	Mixed Oak Dry Woodland	CEGL002150, CEGL002425, CEGL002149
WPO	Ozark/Ouachita Shortleaf Pine - Oak Dry Woodland	CEGL002393
WRC	Red-cedar Alkaline Bluff Woodland	CEGL002426

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